Versar INC. SACRAMENTO

QUARTERLY GROUND-WATER SAMPLING REPORT
HOUSING AUTHORITY OF THE
CITY OF ALAMEDA SITE AT
1916 WEBSTER STREET
ALAMEDA, CALIFORNIA

Prepared for:

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PROJECT SUMMARY

On July 31, 1992, Versar, Inc. (Versar) collected ground-water samples as part of the fourth and final of the presently scheduled rounds of quarterly ground-water sampling event at the Housing Authority of the City of Alameda (HACA) site in Alameda, California. In addition, Versar collected soil and ground-water samples at a depth of approximately six feet below ground surface with a drive-core sampling system to define the limits of the previously identified soil and ground-water contamination.

An underground gasoline storage tank was removed from the site in July 1986, at which time petroleum hydrocarbon contamination was discovered in the soils in the vicinity of the tank. The impacted soils were excavated and aerated on the site prior to being used to backfill the excavation. Two ground-water monitoring wells (MW1 and MW2) were installed in August 1986. Versar conducted a site assessment in July 1991 to define the areal extent of the petroleum hydrocarbon contamination and to determine the local hydraulic gradient. During this assessment, a third ground-water monitoring well (MW3) was installed.

Ground-water monitoring is being conducted as part of the site investigation activities. Each sampling event includes: 1) the measurement of ground-water levels; 2) the determination of the hydraulic gradient; 3) the collection of ground-water samples for analysis for total petroleum hydrocarbons as gasoline (TPH-G), and for benzene, toluene, ethylbenzene, and xylenes (BTEX); and 4) the generation of a report summarizing the results of the sampling event. Mr. James G. Jensen, Geohydrologist, State of California Registered Geologist No. 5560, prepared this report under the guidance of Mr. Michael P. Sellens, Senior Geohydrologist, State of California Registered Geologist No. 4714.

The following conclusions summarize the findings of Versar's ground-water monitoring and sampling report:

- Ground-water samples collected from monitoring wells during this event did not contain TPH-G, benzene, ethylbenzene, or xylenes at or above the relevant method's detection limits. All on-site monitoring wells were sampled.

- The ground-water sample from monitoring well MW2 contained toluene in a concentration of 0.59 micrograms per liter (μg/L), which is below the California DHS Action Level for toluene.

- Ground-water samples collected from monitoring wells MW1 and MW3 did not contain any toluene at or above the method's reporting limit of 0.50 µg/L.

- Soil impacted by petroleum hydrocarbons is restricted laterally to an area of approximately 700 square feet, and vertically from a depth of approximately three feet below ground surface (bgs) to the water table, which occurs at approximately five feet bgs.

- Soil samples collected from drive-core borings B8, B9, B10, B11, B12, and B13 did not contain TPH-G, benzene, toluene, or ethylbenzene at above the relevant method's detection limits.

- The soil sample collected from drive-core boring B9 contained a xylenes concentration of 63 micrograms per kilogram (µg/kg). The soil sample collected from drive-core boring B8 contained a total lead concentration of 18,000 µg/kg.

- Ground-water samples collected from drive-core borings B8, B10, B11, and B13 did not contain TPH-G or BTEX at or above the relevant method's detection limits.

- Ground-water samples collected from drive-core boring B9 contained concentrations of TPH-G, benzene, and xylenes of 2,000 µg/L, 620 µg/L, and 180 µg/L, respectively. The ground-water sample collected from drive-core boring B12 contained a benzene concentration of 1.5 µg/L. The ground-water sample collected from drive-core boring B8 contained a total lead concentration of 140 µg/L.

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This report reflects conditions, operations, and practices as observed during the investigation. Changes or modifications to procedures and/or facilities made after the site visit are not included.

TABLE OF CONTENTS

Page No.

LIST OF FIGURES

Figure No. Title

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

This report describes the methods, procedures, and findings of the fourth round of quarterly ground-water sampling conducted at the Housing Authority of the City of Alameda (HACA) site located at 1916 Webster Street in Alameda, California. The first round was conducted in July 1991. This report also describes the results of additional soil and ground-water sampling conducted at the site.

The City of Alameda has a population of approximately 80,000 people and is located in northwest Alameda County. The site is at the southwest corner of the intersection of Webster Street and Atlantic Avenue and is approximately 0.5 miles south of the Oakland Inner Harbor and 0.75 miles north of San Francisco Bay. The location of the site is shown on Figure 1.

This report has been prepared by Versar Inc. (Versar) on behalf of HACA, which is proposing to develop the site. Prior to developing the site, HACA wants to secure approval from the Alameda County Department of Environmental Health, Hazardous Materials Division and the California Regional Water Quality Control Board (RWQCB) that the site is not a concern to human health or the environment. This investigation was performed as part of the scheduled quarterly sampling activities at the site.

1.1 Site Geology and Geohydrology

The site is located in the Coast Ranges geomorphic province, at an approximate elevation of six feet above mean sea level. The area is tectonically active, being situated between the Hayward Fault on the east and the San Andreas Fault on the west. The underlying bedrock consists of Mesozoic sedimentary and volcanic rocks found throughout the Coast Ranges. The general area surrounding the site is underlain by Quaternary marine and nonmarine terrace deposits consisting of clays and silts. The local soil stratigraphy at the site consists of sandy fill material overlying sandy clays and sands. The uppermost ground water at the site is at approximately five feet below grade, or one foot above mean sea level. The ground-water level data are summarized on Table 1. The local ground-water gradient, as measured on July 31, 1992, is to the north at 0.02 feet per foot.

1.2 Site Background and History

This summary of the site background and history is based on a review of previous work conducted by Aqua Science Engineers, Inc. (Aqua Science). The site is the former operating office for HACA. The site consists of a warehouse and a parking lot. The potential for environmental impairment is based on soil contamination identified during the removal of a 280-gallon gasoline underground storage tank (UST) on July 16, 1986. Although the UST had not been in service for many years, it was reported to contain a mixture of water and leaded gasoline. The UST contents were evacuated prior to the tank removal. A visual inspection did not indicate the presence of any holes in the UST. However, laboratory analysis of soil samples collected from the excavation identified elevated concentrations of total petroleum hydrocarbon as gasoline (TPH-G), as well as elevated concentrations of benzene, toluene, and xylene (Aqua Science, August 11, 1986).

Based on the results of the soil analysis, additional contaminated soil was excavated and additional samples were collected in July and August, 1986. During this time, eight boreholes were drilled on the site, two of which were converted to monitoring wells (MW1 and MW2). Ground-water samples were collected from the borings and the monitoring wells (Aqua Science, September 4, 1986). Results of laboratory analysis of these samples are summarized in Table 2. Locations of the boreholes and monitoring wells are shown on the Site Layout Map (Figure 2).

A review of the site investigation reports determined that soil excavation ceased in a northerly direction when field screening and visual observations indicated that all contaminated soil had been removed. It was reported that approximately 130 cubic yards of contaminated soil was excavated and aerated on the site. The treated soil was used as backfill in the excavation (Aqua Science, October 16, 1986). The previous reports and laboratory analytical results are summarized in the Versar Work Plan report (Versar, March 22, 1991).

No additional work was conducted at the site until 1990 when PRC Environmental Management, Inc. collected ground-water samples from the two monitoring wells (MW1 and MW2) as part of the sampling program for the nearby Alameda Naval Air Station. The samples were analyzed for volatile organic compounds (VOCs) by EPA Method 624 and extractable organic compounds (EOCs) by EPA Method 625. No VOCs or EOCs were reported from either of the monitoring wells (PRC Environmental Management, October 11, 1990).

One additional monitoring well (MW3) was installed by Versar in July 1991. MW3 was installed to determine the local ground-water gradient and to evaluate the ground-water quality. The two previously installed monitoring wells (MW1 and MW2) were evaluated as to their condition and were determined to be suitable for use as monitoring wells. MW1, MW2, and MW3 were developed and ground-water samples were collected. The ground-water samples were analyzed for TPH-G and BTEX. The ground-water samples collected from MW1 and MW3 did not contain TPH-G or BTEX at or above the relevant method's detection limits. The ground-water sample collected from MW2 did not contain TPH-G or toluene at or above the relevant method's detection limits.

Concentrations of benzene, ethylbenzene, and xylenes of 3.7 micrograms per liter (μg/L), 0.50 μg/L, and 5.1 μg/L, respectively, were reported in the ground-water sample collected from MW2. The benzene concentration was slightly above the California Maximum Contaminant Level (Cal MCL) of 1.0 μg/L (Versar, September 20, 1991). Results of laboratory analysis of these samples are summarized in Table 3.

In addition to the installation of MW3, a shallow soil boring (BH-7) was drilled at the north end of the previously excavated area to verify the areal extent of any soil contamination. Soil samples from BH-7 contained concentrations of TPH-G and BTEX, indicating that impacted soil is present north of the previous excavation limits (Versar, September 20, 1991).

The second quarterly ground-water sampling event was conducted on November 15 and 19, 1991 by Versar. MW1, MW2, and MW3 were purged and ground-water samples were collected. The ground-water samples were analyzed for TPH-G and BTEX. The ground-water samples collected from MW1 and MW3 did not contain TPH-G or BTEX at or above the relevant method's detection limits. The ground-water sample collected from MW2 did not contain TPH-G, toluene, or ethylbenzene at or above the relevant method's detection limits, but did contain a benzene concentration of 1.1 μg/L and a xylenes concentration of 4.5 μg/L (Versar, January 27, 1992). Results of the laboratory analyses are summarized in Table 3.

The third quarterly ground-water sampling event was conducted on February 24, 1992 by Versar. MW1, MW2, and MW3 were purged and ground-water samples were collected. The ground-water samples were analyzed for TPH-G and BTEX. The ground-water samples collected from MW1 and MW3 did not contain TPH-G or BTEX at or above the relevant method's detection limits. The ground-water sample collected from MW2 contained a xylenes concentration of 1.6 µg/L (Versar, June 9, 1992). Results of the laboratory analyses are summarized in Table 3.

1.3 Site Investigation Objectives

The primary purpose of this site visit was to perform the fourth quarterly ground-water sampling event at the HACA site. The general objectives were:

- Measure ground-water levels in MW1, MW2, and MW3, and determine the local hydraulic gradient.
- Purge and collect ground-water samples from MW1, MW2, and MW3.
- Analyze the ground-water samples for TPH-G and BTEX.
- Collect soil and ground-water samples for the purpose of defining the limits of the soil and ground-water contamination.
- Prepare the fourth quarterly ground-water sampling report.

2.0 SAMPLING ACTIVITIES

The fourth round of quarterly ground-water monitoring and sampling at the HACA site was conducted on July 31, 1992. The investigation included: 1) measurement of the ground-water levels in MW1, MW2, and MW3; 2) purging of and collecting ground-water samples from MW1, MW2, and MW3; 3) collecting soil and ground-water samples using a drive-core sampling system; 4) laboratory analysis of the samples for TPH-G, BTEX, and total lead; and 5) preparation of the fourth quarterly ground-water sampling report.

2.1 Ground-Water Monitoring and Sampling

Monthly measurements of the depth to ground water commenced in July 1992 the per recommendation from the Alameda County Department of Environmental Health, Hazardous Materials Division, as stated in a letter dated June 19, 1992. On July 21, 1992, the depth to ground water was measured in each monitoring well. Ground water was present at depths below ground surface (bgs) of 4.56 feet, 4.47 feet, and 4.24 feet, in monitoring wells MW1, MW2, and MW3, respectively. These depths, corrected to previous survey data, were used to determine the hydraulic gradient, which was to the north at 0.03 feet per foot. The hydraulic gradient is illustrated on Figure 3. The ground-water level data is listed on Table 1 and included on the hydrograph presented as Figure 4.

On July 31, 1992, prior to conducting any ground-water sampling, the depth to ground water was measured in each monitoring well. Ground water was present at depths bgs of 4.69 feet, 4.75 feet, and 4.37 feet, for monitoring wells MW1, MW2, and MW3, respectively. These depths, corrected to previous survey data, were used to determine the hydraulic gradient, which was to the north at 0.02 feet per foot, as shown on Figure 5. The ground-water level data is listed on Table 1, and is included on the hydrograph presented as Figure 4.

After measurement of ground-water levels on July 31, 1992, all wells were purged and sampled using a precleaned dedicated bailer following procedures outlined in Appendix A. A minimum of 3.5 casing volumes of ground water was purged from each well. Data collected during purging included: 1) the initial depth to ground water; 2) temperature; 3) pH; 4) conductivity; and 5) observations of sheen, odor, free product, and turbidity. Details of the purging were recorded and are included as Appendix B. The ground water in each well was determined to be stable with respect to the physical parameters upon completion of the purging.

Each well was allowed to recover to at least 90 percent of the pre-purge water level. Ground-water samples to be analyzed for TPH-G and BTEX were collected from each well using a precleaned dedicated bailer. The samples for TPH-G and BTEX were placed in precleaned, 40-milliliter (ml) glass vials preserved with hydrochloric acid. Sample containers were labelled with the date and time of collection and stored at approximately 4°C in an insulated cooler. A total of three monitoring well ground-water samples were collected and submitted to Trace Analysis Laboratory (Trace), a California State-certified laboratory, for analysis. The samples were prepared following EPA protocols and were accompanied by Versar's chain-of-custody record. The results of the laboratory analysis are presented in Section 3.0, Laboratory Analytical Results.

On August 26, 1992, the monthly measurement of ground-water levels in monitoring wells MW1, MW2, and MW3 were taken and recorded. Ground water was present at depths of 4.77 feet bgs, 4.90 feet bgs, and 4.47 feet bgs for MW1, MW2, and MW3, respectively. These depths were corrected to the previous survey data and were used to determine the hydraulic gradient, which was to the north at 0.02 feet per foot. The hydraulic gradient is illustrated on Figure 6. The ground-water level data is listed on Table 1 and included on the hydrograph presented as Figure 4.

On October 22, 1992, the monthly measurement of the ground-water levels in monitoring wells MW1, MW2, and MW3 were taken and recorded. Ground water was present at depths of 4.29 feet bgs, 4.78 feet bgs, and 4.78 feet bgs for MW1, MW2, and MW3, respectively. These depths were corrected to the previous survey data and were used to determine the hydraulic gradient, which was to the north-northeast at 0.02 feet per foot. The hydraulic gradient is illustrated on Figure 7. The ground-water level data is listed on Table 1 and included on the hydrograph presented as Figure 4.

2.2 Additional Site Activities

In order to delineate the limits of soil and ground-water contamination, a subsurface sampling program was conducted on July 31, 1992. A series of six borings were drilled at the site using Precision Sampling Inc.'s (PSI) drive-core sampling system. The boring locations are shown on Figure 8. PSI's system involves simultaneously driving inner sampling rods and outer drive casing with a hydraulic driver sampling rig. As the rods and drive casing were advanced, soil was driven into a 1-5/8 inch diameter, 3-foot long sample barrel that was attached to the end of the sampling rods. Continuous 3-foot sections of soil cores were collected in 1-1/2 inch diameter, stainless steel tubes inside the sample barrel as the sampling rods and drive casing were advanced. The average depth of penetration was seven feet. Drilling logs were prepared for each boring and included: 1) lithologic descriptions; 2) sampling depths; 3) headspace measurements using a Foxboro 1286C Organic Vapor Analyzer (OVA); and 4) other related data. Drilling logs are included as Appendix C.

One soil sample was collected from each boring, at a depth immediately above the aquifer, to be analyzed for TPH-G and BTEX. One sample was analyzed for total lead. The soil samples were collected in precleaned, six-inch long, 1-1/2 inch diameter stainless steel tubes. Immediately after collection, the sample tube was sealed with Teflon sheeting, plastic end caps, and tape. The sample was then labelled with identification codes, the date and time of collection, placed in a sealable plastic bag, and then placed on ice in an insulated cooler.

A total of six soil samples were collected and submitted to Trace for analysis. The samples were prepared following EPA protocols and were accompanied by Versar's chain-of-custody records. The results of the laboratory analysis are presented in Section 3.0 Laboratory Analytical Results.

After the last soil sample was collected from each boring, one-inch diameter polyvinyl chloride (PVC) screen was inserted inside the drive casing for the purpose of collecting ground-water samples. The drive casing was withdrawn from the boring, leaving the PVC screen in place. Approximately two hours after inserting the PVC screen, a ground-water sample was collected from each temporary piezometer to be analyzed for TPH-G and BTEX. One additional sample was collected to be analyzed for total lead. The ground-water samples were collected using a non-dedicated stainless steel bailer that was decontaminated using a steam cleaner prior to being inserted at each temporary piezometer. The samples for TPH-G and BTEX analysis were placed in precleaned, 40-ml vials preserved with hydrochloric acid. The sample for total lead analysis was placed in a precleaned, 500-ml plastic container preserved with nitric acid. Sample containers were labelled with identification codes, and the date and time of collection, placed in a resealable plastic bag, and placed on ice in an insulated cooler.

A total of six drive-core boring ground-water samples were collected and submitted to Trace for analysis. The samples were prepared following EPA protocols and were accompanied by Versar's chain-of-custody records. The results of the laboratory analysis are presented in Section 3.0 Laboratory Analytical Results.

Drilling spoils, decontamination water, and purge water were placed in 55-gallon, Department of Transportation (DOT)-approved steel drums for later disposal. After completion of the sampling activities, all drive-core borings were sealed with a bentonite-cement grout from bottom to surface.

3.0 LABORATORY ANALYTICAL RESULTS

A total of nine ground-water samples and six soil samples were collected for laboratory analysis for TPH-G and BTEX. The soil and ground-water samples collected from boring B8 were also analyzed for total lead. TPH-G was analyzed for following the DHS method, LUFT Field Manual, and BTEX was analyzed for following a modified EPA Method 8020. Total lead was analyzed for following EPA Method 7420. The complete analytical procedure for each method is included in Appendix D. A copy of the laboratory analytical results and chain-of-custody records are included as Appendix D.

3.1 Ground-Water Monitoring Well Sample Results

Trace reported the ground-water samples collected from MW1 and MW3 did not contain TPH-G or BTEX at or above the relevant method's reporting limits.

The ground-water samples collected from MW2 did not contain TPH-G, benzene, ethylbenzene, or xylenes at or above the relevant method's reporting limits. A toluene concentration of 0.59 μg/L was detected in the ground-water sample collected from monitoring well MW2. This concentration is below the Cal DHS Action Level of 100 μg/L for toluene. Monitoring well ground-water sample results are summarized in Table 3 and on Figure 9.

3.2 Drive-Core Boring Sample Results

The soil samples collected from borings B8, B10, B11, B12, and B13 did not contain TPH-G or BTEX at or above the relevant method's reporting limits. The soil sample collected from boring B9 did not contain TPH-G, benzene, toluene, or ethylbenzene at or above the relevant method's reporting limits. A total xylenes concentration of 63 micrograms per kilogram (μg/kg) was reported from the soil sample collected from boring B9. A total lead concentration of 18,000 μg/kg was reported in the soil sample collected from boring B8. Drive-core boring soil sample results are summarized in Table 4 and on Figure 10.

Analyses of ground water from grab samples collected during the drive-core sampling operation were used to define the extent of impacted ground water at the site. The ground-water samples collected from borings B8, B10, B11, and B13 did not contain TPH-G or BTEX at or above the relevant method's reporting limits. The ground-water sample collected from boring B9 contained concentrations of TPH-G, benzene, and xylenes of 2,100 μg/L, 620 μg/L, and 180 μg/L, respectively. The ground-water sample collected from boring B12 contained a concentration of benzene of 1.5 μg/L. A total lead concentration of 140 μg/L was detected in the ground-water sample collected from boring B8. Drive-core boring ground-water sample results are summarized in Table 5 and on Figure 11.

5.0 CONCLUSIONS

This section provides a brief summary of the findings of the fourth round of quarterly ground-water monitoring and sampling and the results of the drive-core sampling operation.

5.1 Project Findings

The significant findings of Versar's investigation are as follows:

- TPH-G, benzene, ethylbenzene, and xylenes were not identified in ground-water samples collected from any monitoring well.
- Toluene was identified at a concentration of 0.59 µg/L in the ground-water sample collected from monitoring well MW2. This concentration is below the California DHS Action Level.
- Toluene was not identified in ground-water samples collected from monitoring wells MW1 or MW3.
- The hydraulic gradient is generally to the north at an average gradient of 0.02 feet per foot.
- TPH-G, benzene, toluene, and ethylbenzene were not identified in soil samples collected from any of the drive-core borings.
- Total xylenes were identified at a concentration of 63 µg/kg in the soil sample collected from boring B9.
- A total lead concentration of 18,000 µg/kg, is reportedly indicative of background concentrations.
- TPH-G and BTEX were not identified in grab ground-water samples collected from borings B8, B10, B11, and B13.
- TPH-G, benzene, and xylenes were identified at concentrations of 2,000 µg/L, 620 µg/L, and 180 µg/L, respectively, in the grab ground-water sample collected from boring B9. Benzene was identified at a concentration of 1.5 µg/L in the grab ground-water sample collected in boring B12.

- A total lead concentration of 140 µg/L was identified in the grab ground-water sample collected in boring B8.

5.2 Conclusions

Based on data collected during the investigation, it is Versar's opinion that the subsurface contamination identified at the HACA site consists of petroleum hydrocarbons in the gasoline range. Impacted soil is defined as soil with a TPH-G concentration greater than 10 parts per million (ppm) and a BTEX concentration greater than one ppm. Impacted ground water is defined as ground water with TPH-G and BTEX concentrations above background levels, as per the RWQCB. An assumption was made that the previously excavated soil is within the acceptable levels for TPH-G and BTEX. This can only be confirmed by field screening that would be conducted during any additional excavation work. The total volume of impacted soil at the site is estimated to be 50 cubic yards. The total area of impacted ground water is estimated at 2,300 square feet.

Petroleum hydrocarbon-impacted soil and ground water appears to be restricted to the area of the previous UST excavation. Migration of the contaminant plume is restricted by: 1) asphalt paving which covers the site; and 2) the nature of the soil, which is composed of clay and clayey sand. TPH-G has not been identified in any monitoring well ground-water samples collected since ground-water monitoring commenced in July 1991. Benzene concentrations exceeded the California MCL in a monitoring well ground-water sample collected from monitoring well MW2, only during the first round of sampling, in July 1991. Benzene has not been identified in monitoring well ground-water samples collected during the last two sampling episodes.

6.0 REMEDIAL OPTIONS

Soils and ground water at the HACA site have been impacted with petroleum hydrocarbons. Impacted soil is defined as soil with a TPH-G concentration greater than 10 ppm and a BTEX concentration greater than one ppm. Soil contamination is present from approximately two feet bgs to the water table at approximately five feet bgs. The approximate extent of impacted soils and ground water are indicated on the site maps included as Figures 10 and 11. The amount of product present in the soils at the HACA site is estimated at 20 pounds, or three gallons of gasoline. This estimate is based on 50 cubic yards of impacted soil with an estimated TPH-G concentration of 100 milligrams per kilogram (mg/kg), (approximately equal to ppm).

Remediation alternatives at the HACA site must consider impacted soils in the vadose and the saturated zones. This section describes potential remedial options for both soil and ground water at the site.

The following sections describe remedial action options with relative feasibility, approximate cost, and a brief risk appraisal for each. Remediation options to address petroleum hydrocarbon-impacted soils include: (1) no action; (2) soil excavation and disposal; (3) soil excavation and bioremediation; (4) soil excavation and thermal desorption; and (5) in-situ soil vapor extraction. Ground-water remediation options include: (1) ground-water monitoring; (2) ground-water in-situ bioremediation; (3) ground-water pumping and treatment from pumping wells; and (4) pumping and treating of ground water from excavation.

6.1 Petroleum Hydrocarbon-Impacted Soil Remediation Options

6.1.1 No Action

The no-action option considers the following factors for determining the fate and mobility of petroleum hydrocarbons at the site: (1) estimated quantity of gasoline in the soil beneath the site; (2) ability of the soil to immobilize the gasoline; (3) contaminant solubility and water transport; (4) vapor generation and migration; and (5) weathering. These factors are discussed below.

Based on data obtained during Versar's investigation, the estimated quantity of gasoline present in the soils beneath the UST excavation site is 20 pounds or three gallons.

The soil's ability to immobilize a given concentration of product is dependant on two factors: (1) soil porosity; and (2) the maximum product residual saturation below which the product will not move as a liquid through the soil. Porosities for sands vary from 25 to 50 percent. Residual hydrocarbon saturation for gasoline is empirically derived and is estimated at 10 percent (Calabrese and Kostecki, 1989). Based on these values, the soil at the site could stabilize concentrations of between 8,500 mg/kg and 17,024 mg/kg (Calabrese and Kostecki, 1989). These concentrations are above those identified in soils beneath the site.

Gasoline is a hydrophobic compound and contains few, if any, lighter fractions which may be slightly soluble in water. However, water transport through the vadose zone is likely because of the permeability of the soil, as discussed in Section 1.1. Movement of gasoline through the vadose zone via water transport may be significant.

Vapor generation has occurred because of the volatile nature of the gasoline. The results of field headspace analysis indicate vapor generation and migration have occurred at the site.

Weathering is the process by which the lighter fractions of petroleum hydrocarbons volatilize and decrease the overall concentration of hydrocarbons in the soil. Naturally occurring bacteria enhance the weathering process through biodegradation. Both processes have been acting upon the gasoline since its release. Evidence of the weathered state of the hydrocarbons is indicated by low to moderate residual concentrations of the volatile BTEX components. The ultimate byproducts of weathering are carbon dioxide and water.

The risk associated with the no-action option was calculated using the General Risk Appraisal analysis described in the LUFT Field Manual. The risk analysis begins with a leaching potential analysis. Based on a score of 39 points for the site (due to sandy soils and proximity of ground water), the maximum allowable TPH level for soil in place is 10 ppm of gasoline. Based on this analysis, remedial action is required for the site.

6.1.2 Soil Excavation and Disposal

Soil excavation and offsite disposal involves removing the impacted soil by excavation and transporting the soils to a permitted facility for treatment or disposal. The excavated area would then be backfilled with clean soil. The benefits of this option include: (1) reduction in the amount of impacted soil onsite; (2) completion of the project within a relatively short period of time; and (3) verification of the remedial action through soil testing following the excavation. Up to a total of 160 cubic yards may need to be excavated, of which approximately 50 cubic yards would exceed the acceptable contaminant concentration level.

Based on the general risk assessment described in the no-action option alterative of this section, soils at the site should be excavated until laboratory analysis of soil samples collected from the floor and sidewalls of the excavation identify a TPH-G concentration of 10 ppm or less. The general risk appraisal also concludes that benzene, toluene, ethylbenzene, and total xylenes concentrations be below the method reporting limit of 1 ppm.

The costs for excavation and disposal vary according to the location of the disposal facility and their treatment/disposal method. The overall cost is estimated to be $16,000.

6.1.3 Soil Excavation and Bioremediation

Soil excavation and onsite bioremediation involves removal of the impacted soil to a lined bioremediation cell within the boundaries of the subject property. The aeration cell would be constructed to contain 100 percent of any runoff produced during the bioremediation process. Construction of the cell involves spreading of the excavated impacted soil into a three- to four-foot high layer and providing microorganisms, nutrients, water, and air which, in association with the natural aeration, will break down the contamination present. Following confirmation that all impacted soil has been removed, the excavation will be backfilled with clean imported fill. During the remediation process, regular maintenance and sampling of the cell would be conducted to monitor the progress and to enhance the remediation. Remediation of the impacted soils could be completed within approximately 6 months. Following laboratory confirmation that the remediated soil contains TPH-G concentrations of less than 100 ppm and BTEX concentrations of less than 1 ppm, the soil can be removed to a Class III landfill. Risk analysis for this option is the same as for the Soil Excavation and Disposal option.

Disadvantages of this option include retaining the contaminated soil onsite until the remediation is completed and continual maintenance of the bioremediation cell. Advantages of this option include the ultimate destruction of the contaminant, subsequent release of future liabilities with respect to the disposal of the impacted soil, control of the remediation process through proper maintenance and monitoring, and reduced costs as compared to disposal without bioremediation. The cost of this option is estimated at $15,000.

6.1.4 Soil Excavation and Thermal Desorption

Another option is on-site or off-site thermal desorption treatment of the contaminated soil. On-site thermal treatment involves the heating of the contaminated soil in a mobile conveyer/heat exchanger, which vaporizes the petroleum hydrocarbons adsorbed to the soil. The vapors are processed through a high pressure scrubber to separate dust, water droplets and some organics. Prior to the release of the air emissions, the vapors are sent through activated carbon adsorbers. This method is often a very cost-efficient method when large volumes are considered. Off-site thermal desorption treatment involves the same type of treatment but with the additional expense of transportation and disposal of the impacted soil. Currently, there are several permitted hydrocarbon thermal treatment facilities located within 150 miles of the subject site.

The advantages of on-site thermal treatment are that remediation can be completed within two to three weeks and that treated soil can probably be used to fill on-site. Advantages for off-site treatment include the immediate treatment and availability of permitted treatment facilities. The disadvantages for both on-site and off-site thermal treatment include the overall expense and, for on-site treatment, the potential air quality permitting restrictions.

On-site thermal treatment, including excavation and treatment, is estimated to cost $21,000. Based on the excavation, transportation, thermal desorption and disposal cost involved with off-site thermal treatment, the cost for that alternative is estimated to be $15,000.

6.1.5 In-Situ Soil Vapor Extraction

In-situ soil vapor extraction (SVE) is a process where air and hydrocarbon vapors are extracted from the impacted soils using vapor extraction wells (VEW). Several VEWs would be installed in the impacted area. One of the VEWs would be used as an active extraction source while one or more additional VEWs are used as passive injection sources. As the hydrocarbon concentration within the soil gas is reduced, additional hydrocarbons are desorbed from the soil matrix. The process continues until the soil hydrocarbon concentrations are reduced to below the target cleanup level of 100 ppm for TPH-G and 1 ppm for BTEX. The air and hydrocarbon vapor mixture is then treated to remove the hydrocarbons prior to discharge to the atmosphere. Air/hydrocarbon treatment alternatives include activated carbon adsorption, thermal destruction, and catalyst-assisted oxidation. In-situ remediation of the soils could be completed within approximately two years. Risk analysis for this option is the same as for the Soil Excavation and Disposal option. The estimated cost for this option is $130,000.

6.2 <u>Petroleum Hydrocarbon-Impacted Ground-Water Remediation Options</u>

6.2.1 Ground-Water Monitoring

Ground-water monitoring is an option for monitoring the continued impact on the ground water at the HACA site. It can be used in conjunction with other soil and ground-water remediation options to monitor changes in ground-water quality before, during, and after the remediation process. It involves the periodic measuring of the water table and the collection of ground-water samples to monitor changes in the ground-water flow direction and progress of the remediation. Monitoring wells presently in place at the site can be used for this option. Installation of an additional monitoring well in an upgradient location should be considered.

Costs incurred for this option include continued monitoring and sampling of the three wells on the site during and after the remediation. The cost is estimated at $10,000 per year. Installation of one additional monitoring well is estimated to cost $6,000.

6.2.2 Ground-Water In-Situ Bioremediation

In-situ ground-water bioremediation is a process where nutrients, oxygen, and microorganisms are injected into the impacted ground water through a series of injection wells, for the purpose of breaking down the identified contamination. During the remediation process, regular maintenance and sampling of the ground water is conducted to monitor the progress and to enhance the remediation. The remediation target levels are concentrations of TPH-G below 0.05 ppm and BTEX components below 0.0005 ppm. The process generally is limited to homogeneous, high permeability soils. Small variations in soil permeability greatly affect the uniformity of this remediation technique, possibly leaving portions of the impacted ground water untreated.

The time to remediate the impacted ground water is estimated at a minimum of four years. Costs for this option are estimated at $180,000.

6.2.3 Ground-Water Pumping and Treatment from Pumping Wells

Remediation of impacted ground-water involves extracting the ground water and treating it to an acceptable level so that the water may be discharged to: (1) the surface water under a National Pollutant Discharge Elimination System permit; (2) the publicly-owned water treatment works; or (3) back into the ground. Capture and extraction of the ground water would be from one or more pumping wells. Treatment of the impacted ground water would be accomplished by a variety of techniques, including filtration, activated carbon adsorption, air stripping, or ozonation. Treated ground water is most commonly discharged to a local wastewater treatment plant. Remediation of the ground water by pumping and treatment could be completed within approximately four years. The estimated cost for this option is $160,000.

6.2.4 Pumping and Treating of Ground Water from Excavation

If a soil excavation option is selected, ground-water samples should be collected from the excavation and submitted for laboratory analysis. If impacted ground water is identified, the water can be pumped from the excavation and treated by one of the techniques discussed in Section 6.2.3. It may be necessary to evacuate several excavation-volumes of ground water to reach acceptable contaminant concentrations under applicable regulations. The treated ground water may be discharged to a local wastewater treatment plant. Estimated cost for this option is $30,000.

7.0 RECOMMENDATIONS

Versar makes the following recommendations to ensure compliance with state and federal regulations. These recommendations are based on the Tri-Regional Board Staff Recommendations for Preliminary Investigation and Evaluation of Underground Tank Sites. Estimated cost for implementing the recommended remediation system is $61,000.

7.1 Ground-Water Monitoring

Ground-water monitoring and sampling in the three existing monitoring wells, MW1, MW2, and MW3, should continue on a quarterly basis. This will allow for: (1) continued observation of ground-water level changes; (2) monitoring of ground-water quality; and (3) evaluation of the site remediation progress. Versar recommends the installation of an additional monitoring well upgradient of the former UST location near the location of boring B8. In addition, analysis for total lead and organic lead should be added to the regular quarterly sampling episodes to confirm laboratory analytical results from boring B8.

7.2 Remediation Recommendations for Soil

Based on the estimated volume of impacted soil and the available space at the site, thermal desorption appears to be the most cost-effective remedial technology. Off-site thermal treatment involves the excavation of the impacted soil and treatment by thermal desorption. Versar estimates that approximately 160 cubic yards (yds^3) of soil will be excavated, of which approximately 50 yds^3 contains petroleum hydrocarbon contamination. Following laboratory confirmation that all impacted soil has been removed, the excavation will be backfilled with clean imported fill. Based on Versar's experience, it is believed that remediation of 50 yds^3 of gasoline-impacted soil could be completed within approximately one month.

7.3 Remediation Recommendations for Ground Water

Versar recommends the excavation be to a depth equal to the ground-water table because soil contamination is present at the ground-water surface. If ground water is present in the excavation at the completion of the excavating, ground-water samples should be collected and submitted for laboratory analysis to determine if any ground-water contamination is present. If ground-water contamination is identified, the water should be evacuated from the excavation and treated according to the contaminant levels identified. It may be necessary to evacuate two to three excavation volumes of ground water to reach the contaminant concentrations acceptable for federal and state regulations. After treatment of the evacuated ground water to acceptable regulatory levels, the water may be pumped to the sanitary sewer system.

8.0 REFERENCES

This investigation of the HACA site utilized the reference materials and reports documented below:

Alameda County Department of Environmental Health, Hazardous Materials Division, June 19, 1992, Letter to the City of Alameda Housing Authority.

Aqua Science Engineers, Inc., August 11, 1986, A Proposal for Soil and Water Investigation at the Alameda Housing Authority.

Aqua Science Engineers, Inc., September 4, 1986, Soils Investigation - A Summary of Findings and a Proposal for Remedial Action.

Aqua Science Engineers, Inc., October 16, 1986, Soil and Water Quality Treatment Summary and Recommendations - A Final Report.

Davis, S.N., 1966, Hydrogeology Field Trip East Bay Area and Northern Santa Clara Valley, in Geology of Northern California: California Division of Mines and Geology, Bulletin 190, p. 465-471.

Norris, R.M. and Webb, R.W., 1990, Geology of California: John Wiley and Sons, New York, 541 p.

PRC Environmental Management, Inc., October 11, 1990, Copy of Laboratory Analytical Results.

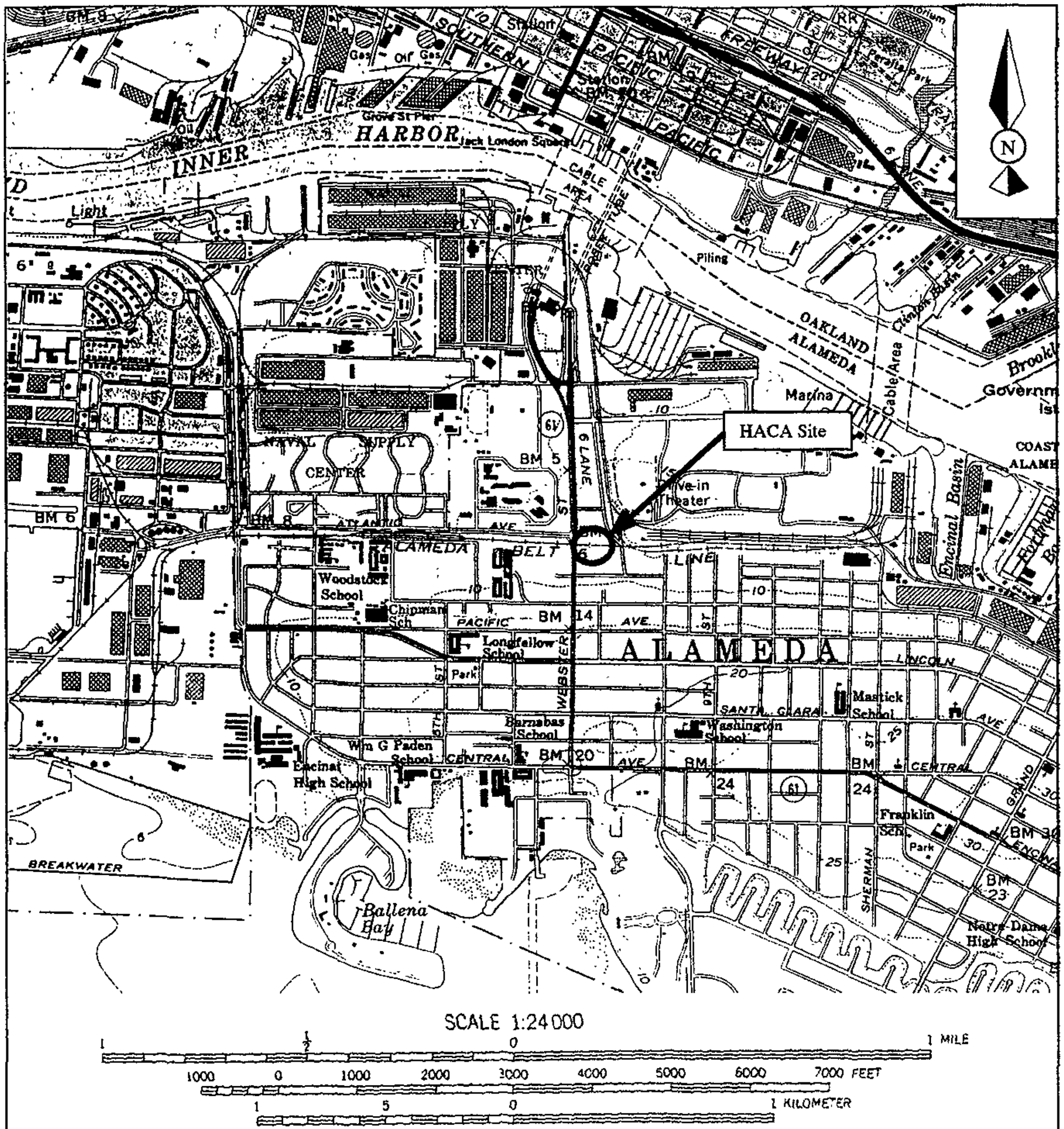
U.S. Geological Survey Topographical Map, 7.5 Minute Series, Oakland West, California Quadrangle, 1959 (Photorevised 1980).

Versar Inc., March 22, 1991, Work Plan for the Subsurface Evaluation at 1916 Webster Street, Alameda, California.

Versar Inc., September 20, 1991, Stage One Site Assessment of the Housing Authority of the City of Alameda Site at 1916 Webster Street, Alameda, California.

Versar Inc., January 27, 1992, Quarterly Ground-Water Sampling Report, Housing Authority of the City of Alameda Site at 1916 Webster Street, Alameda, California.

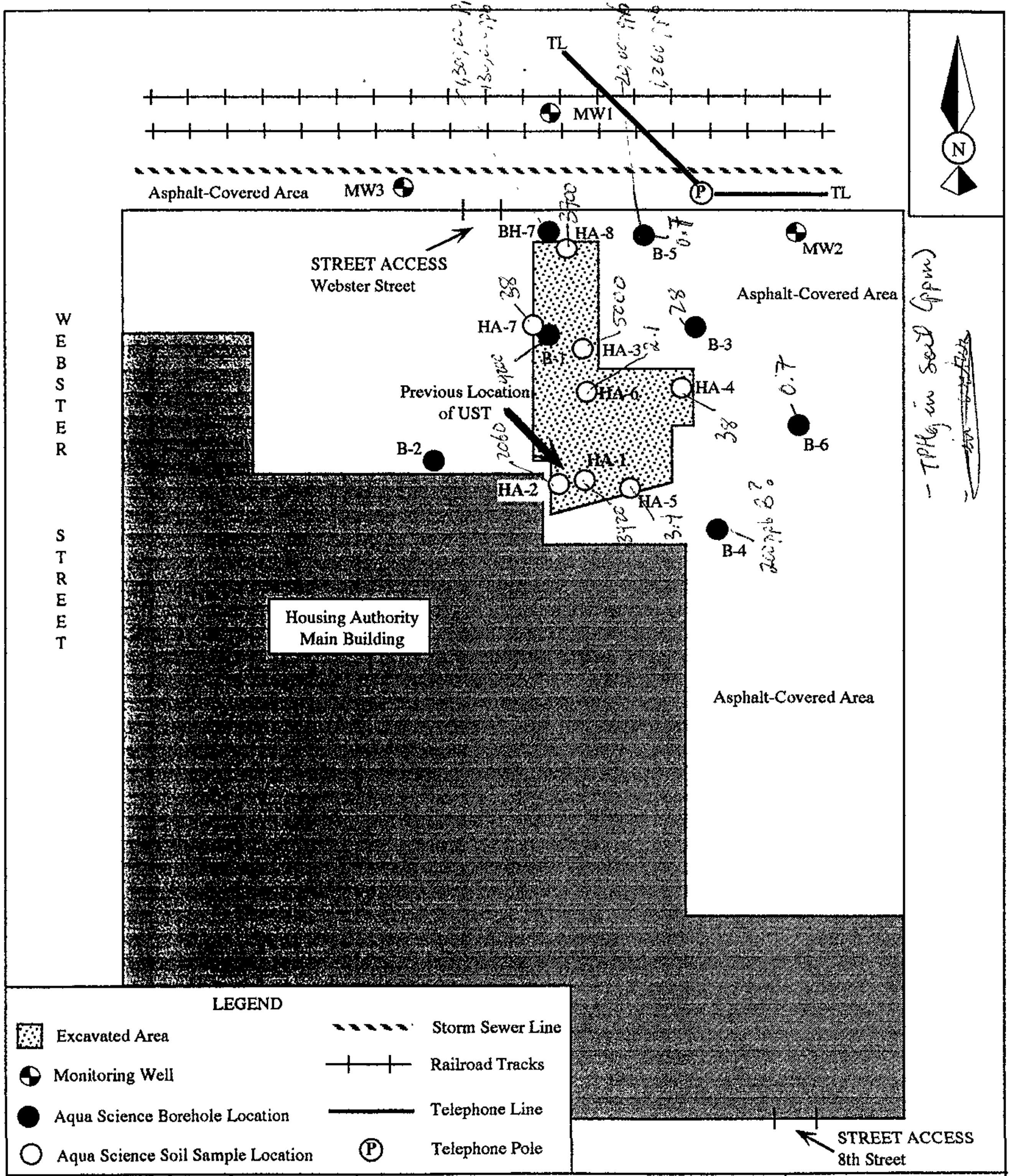
Versar Inc., June 9, 1992, Quarterly Ground-Water Sampling Report, Housing Authority of the City of Alameda Site at 1916 Webster Street, Alameda, California.



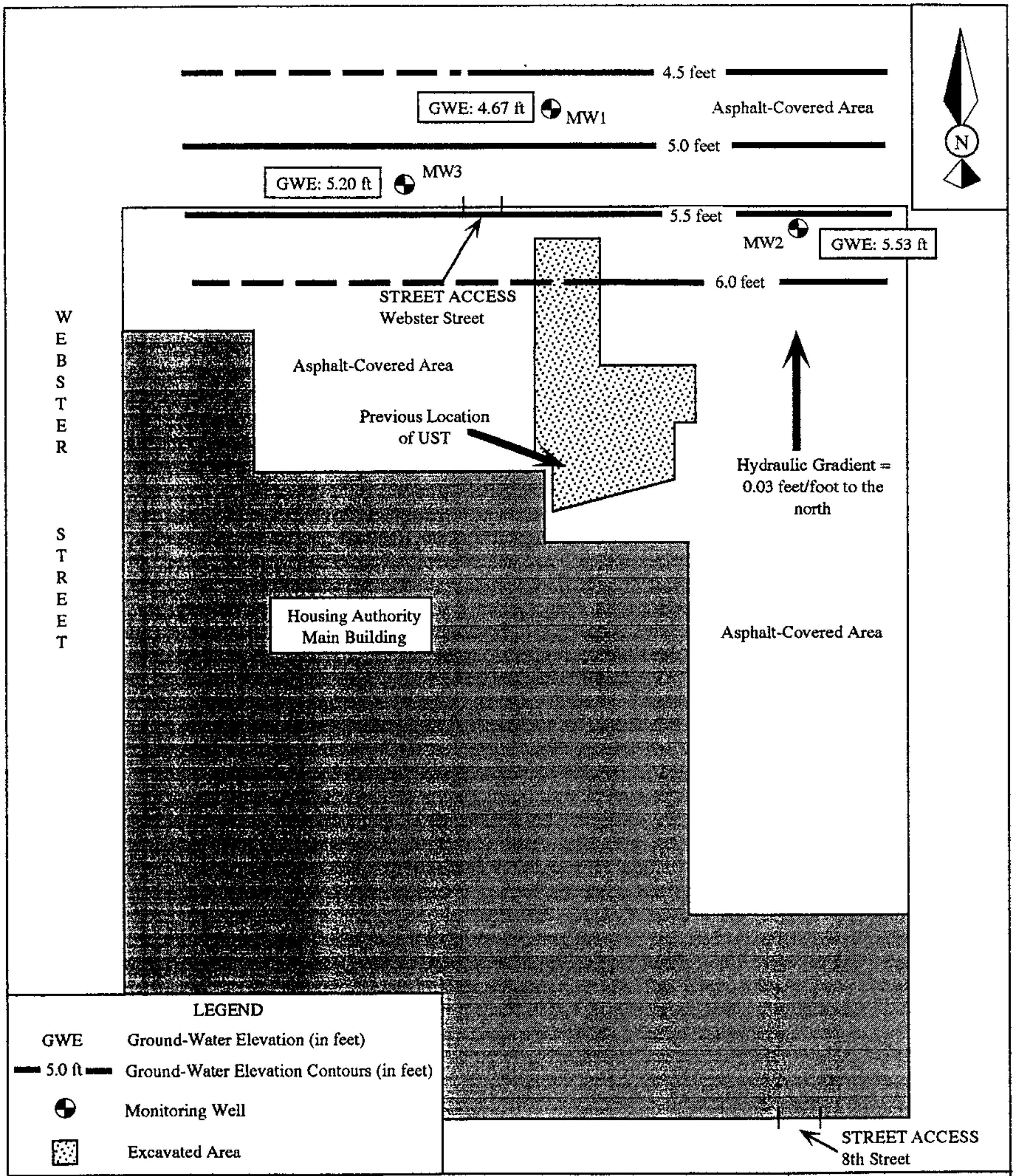
CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES IN FEET—DATUM IS MEAN LOWER LOW WATER

Source . USGS, Oakland West, California, 1959, Photorevised 1980

Scale 1:24,000	Site Location Map	Figure 1
Project No. 1457-022	Housing Authority of the City of Alameda Alameda, California	**Versar Inc.**



0 15 30 45 Scale in Feet	Site Layout Map	Figure 2
Project No. 1457-022	Housing Authority of the City of Alameda Alameda, California	**Versar Inc.**



0 15 30 45

Scale in Feet

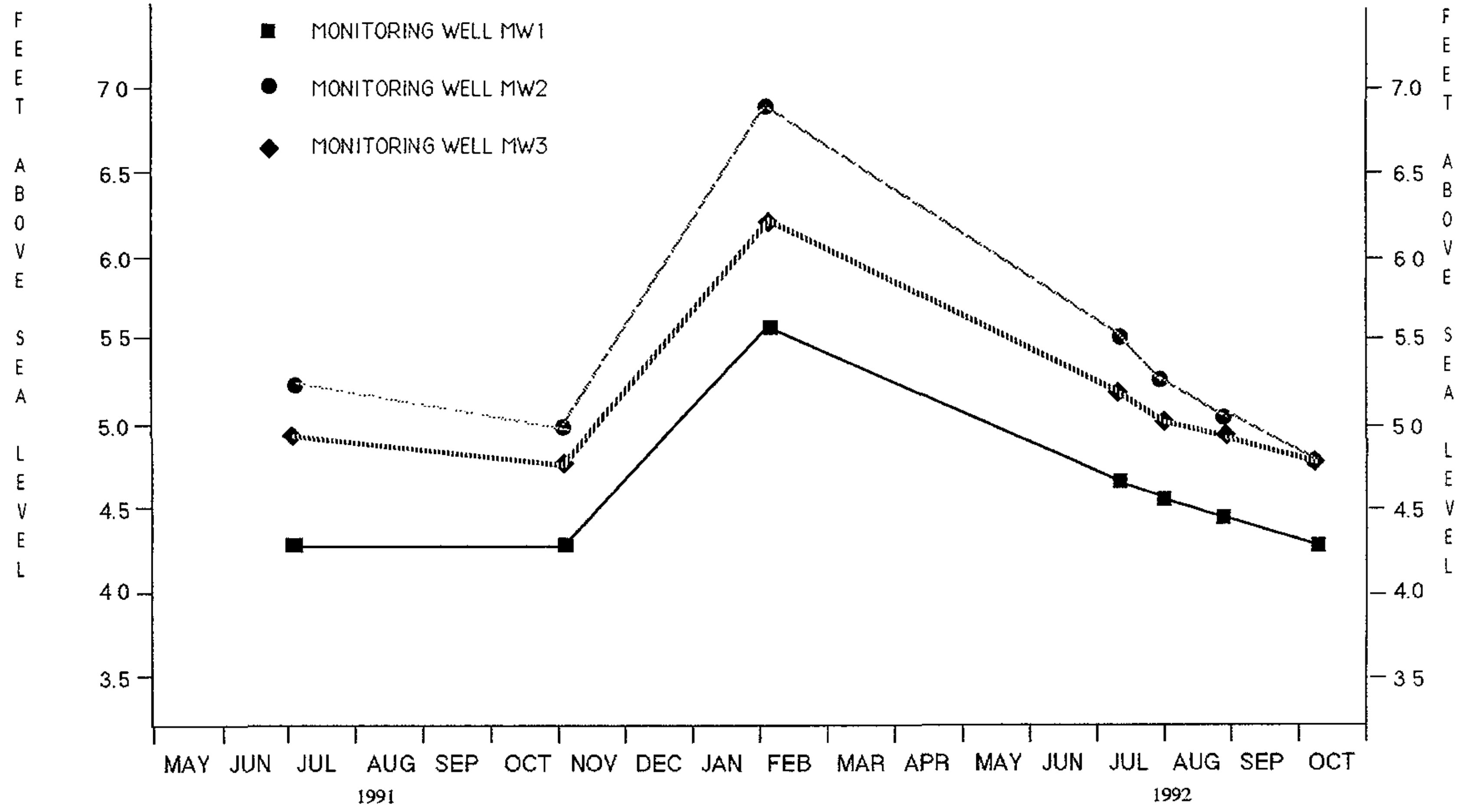
Project No. 1457-022

Contour Map of Ground-Water Levels with Hydraulic Gradient, July 21, 1992

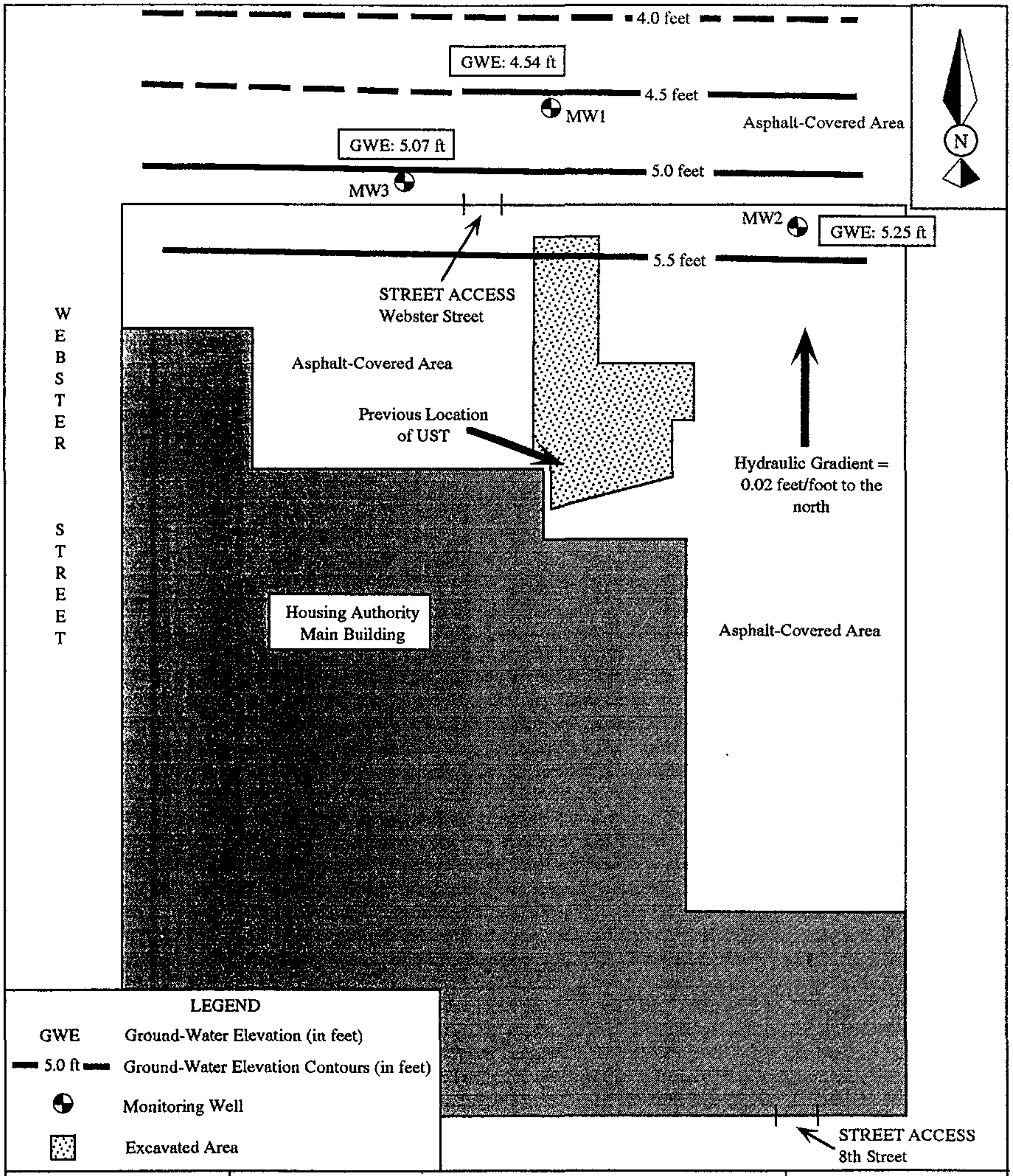
Housing Authority of the City of Alameda
Alameda, California

Figure 3

Versar Inc.



No Scale	Hydrograph of Ground-Water Levels	Figure 4
Project No. 1457-022	Housing Authority of the City of Alameda Alameda, California	**Versar Inc.**



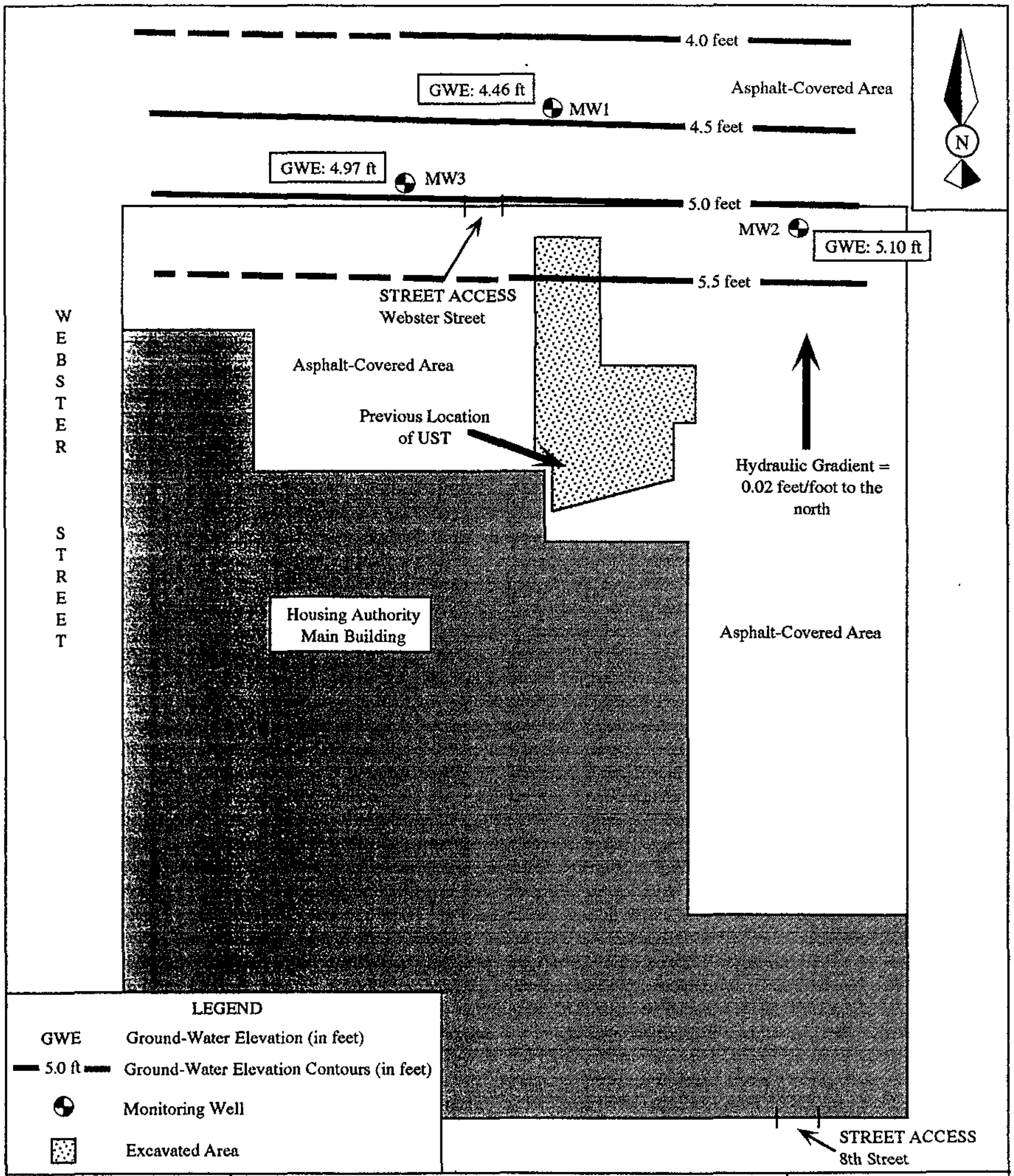
Project No. 1457-022

Contour Map of Ground-Water Levels with Hydraulic Gradient, July 31, 1992

Housing Authority of the City of Alameda
Alameda, California

Figure 5

Versar Inc.



0 15 30 45

Scale in Feet

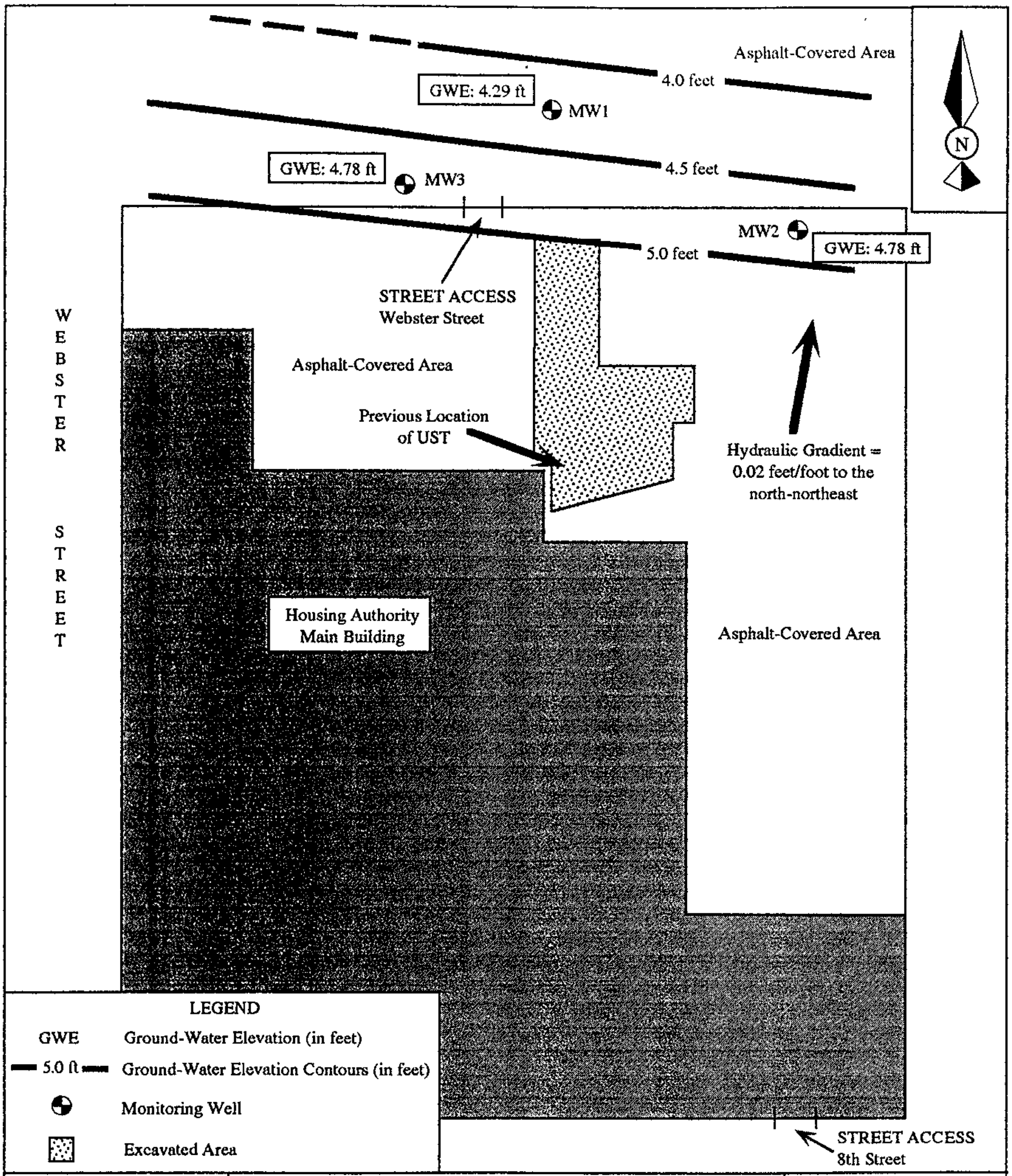
Contour Map of Ground-Water Levels with Hydraulic Gradient, August 26, 1992

Figure 6

Project No. 1457-022

Housing Authority of the City of Alameda
Alameda, California

Versar Inc.



0 15 30 45

Scale in Feet

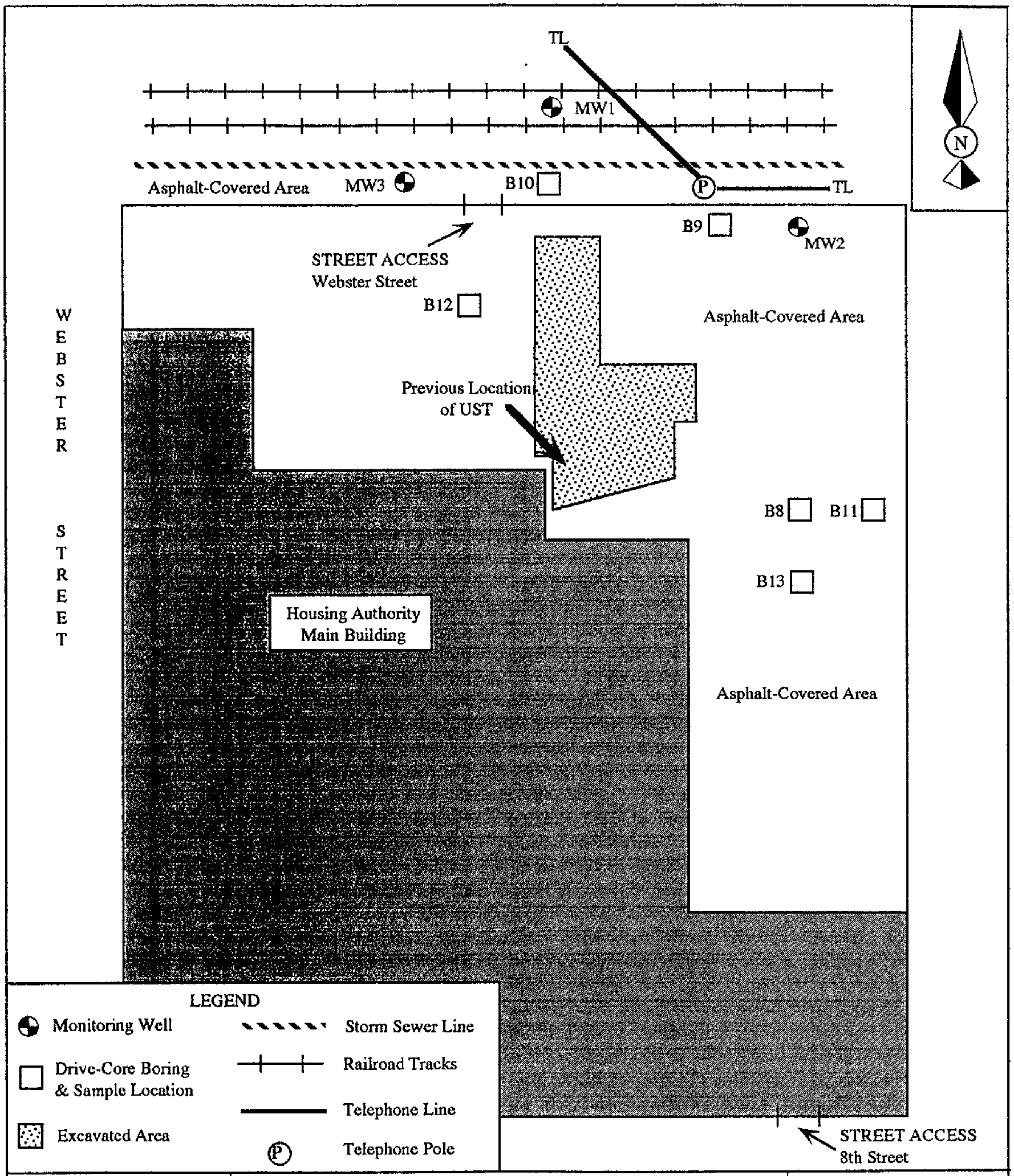
Project No. 1457-022

Contour Map of Ground-Water Levels with Hydraulic Gradient, October 22, 1992

Housing Authority of the City of Alameda
Alameda, California

Figure 7

Versar Inc.



0 15 30 45
Scale in Feet

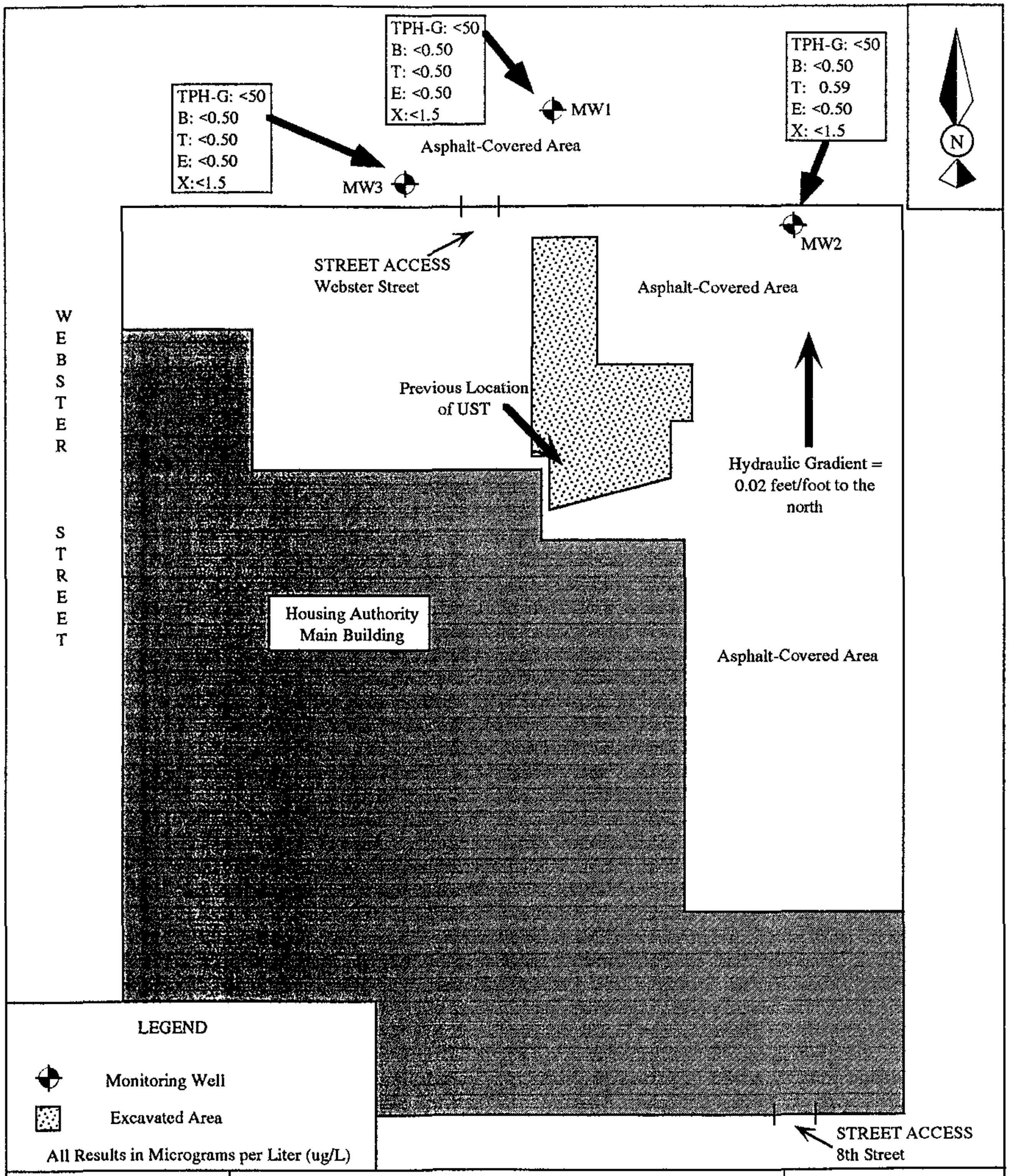
Project No. 1457-022

Drive-Core Boring and Sample Locations, July 31, 1992

Housing Authority of the City of Alameda
Alameda, California

Figure 8

Versar Inc.



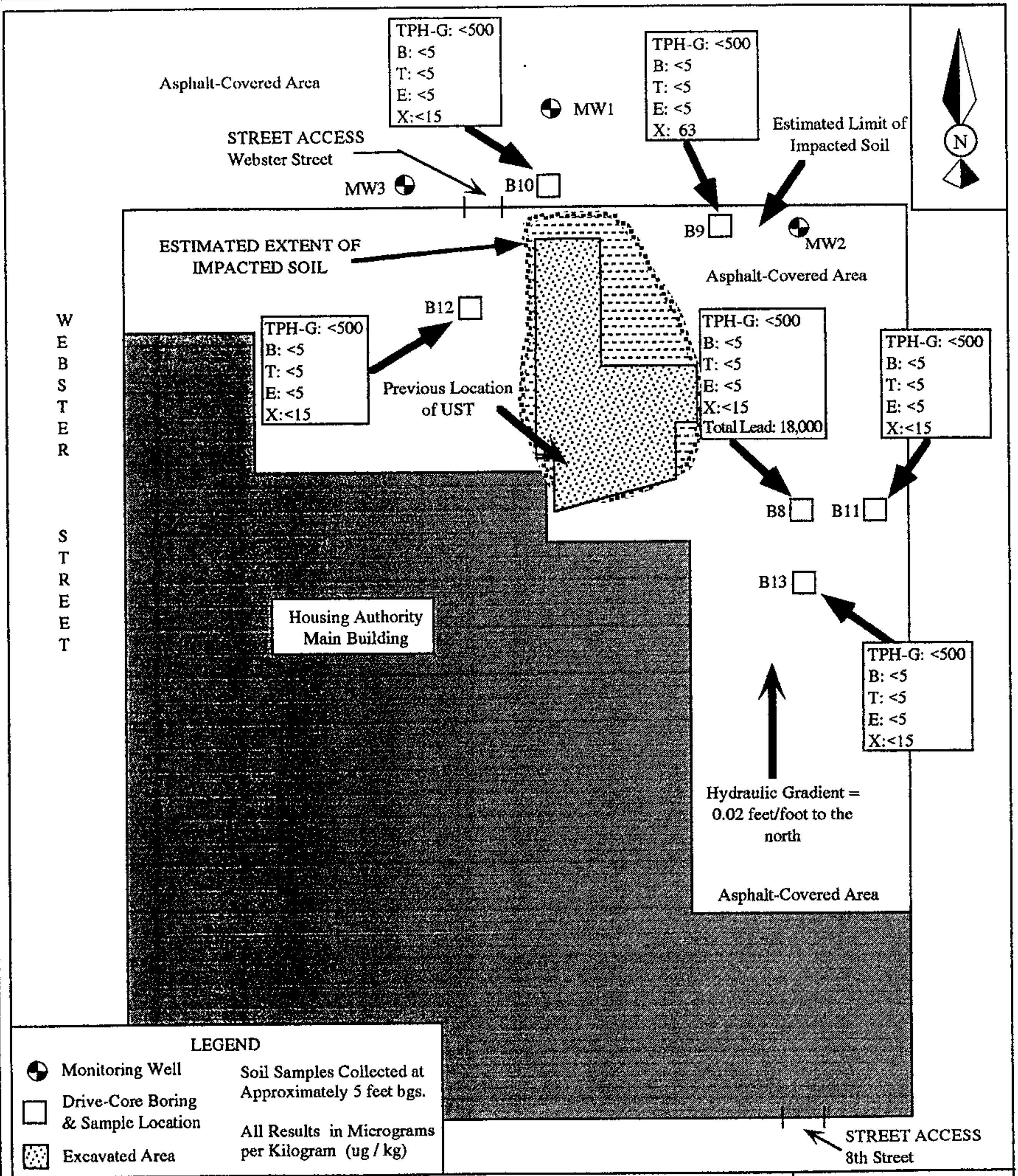
Laboratory Analytical Results for Monitoring Well Ground-Water Samples, July 31, 1992

Figure 9

Project No. 1457-022

Housing Authority of the City of Alameda
Alameda, California

Versar Inc.



0 15 30 45

Scale in Feet

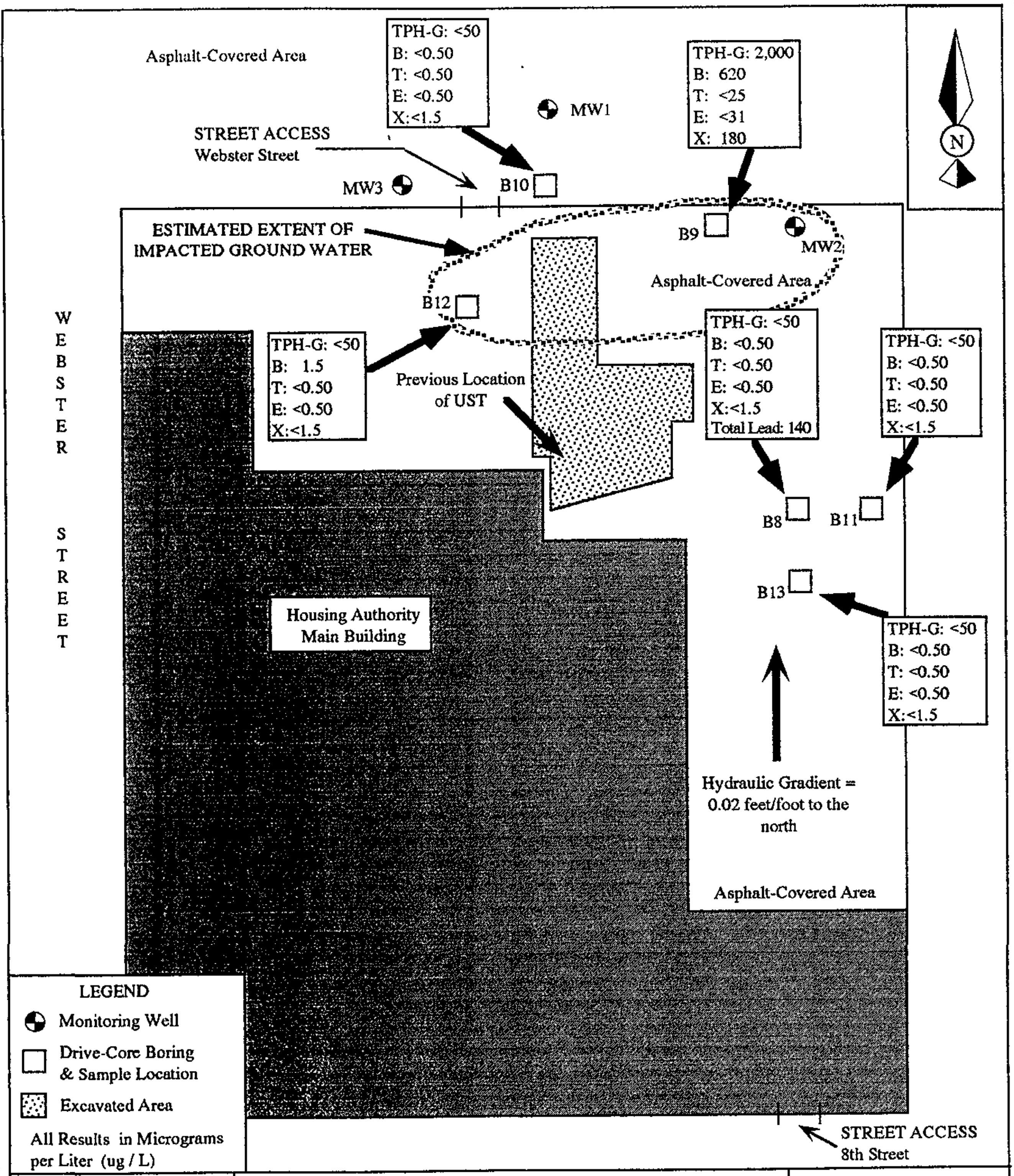
Project No. 1457-022

Laboratory Analytical Results for Drive-Core Boring Soil Samples, July 31, 1992

Housing Authority of the City of Alameda
Alameda, California

Figure 10

Versar Inc.



0 15 30 45 Scale in Feet	Laboratory Analytical Results for Drive-Core Boring Ground-Water Samples, July 31, 1992	Figure 11
Project No. 1457-022	Housing Authority of the City of Alameda Alameda, California	**Versar Inc.**

TABLE 1

MONITORING WELL GROUND-WATER LEVELS

Housing Authority of the City of Alameda
Alameda, California

	MW1	MW2	MW3	Hydraulic Gradient (feet/foot)
Reference Casing Elevation (feet)	9.23	10.0	9.44	
<u>July 16, 1991</u>				0.03 to the north
Depth to Ground Water (feet)	4.92	4.76	4.50	
Ground-Water Elevation (feet)	4.31	5.24	4.94	
<u>November 15, 1991</u>				0.02 to the north
Depth to Ground Water (feet)	4.92	5.0	4.65	
Ground-Water Elevation (feet)	4.31	5.0	4.79	
<u>February 24, 1992</u>				0.04 to the north-northwest
Depth to Ground Water (feet)	3.65	3.10	3.23	
Ground-Water Elevation (feet)	5.58	6.90	6.21	
<u>July 21, 1992</u>				0.03 to the north
Depth to Ground Water (feet)	4.56	4.47	4.24	
Ground-Water Elevation (feet)	4.67	5.53	5.20	
<u>July 31, 1992</u>				0.02 to the north
Depth to Ground Water (feet)	4.69	4.75	4.37	
Ground-Water Elevation (feet)	4.54	5.25	5.07	
<u>August 26, 1992</u>				0.02 to the north
Depth to Ground Water (feet)	4.77	4.90	4.47	
Ground-Water Elevation (feet)	4.46	5.10	4.97	
<u>October 22, 1992</u>				
Depth to Ground Water (feet)	4.94	5.22	4.66	0.02 to the north-northeast
Ground-Water Elevation (feet)	4.29	4.78	4.78	

TABLE 2

LABORATORY ANALYTICAL RESULTS FOR GROUND WATER[1] PREVIOUS INVESTIGATION[2]

Housing Authority of the City of Alameda
Alameda, California

Sample ID	TPH as Gasoline[3] (mg/l)	Benzene[4] (mg/l)	Toluene (mg/l)	Ethylbenzene (mg/l)	Xylenes (mg/l)
<u>July and August, 1986</u>					
B-1	37	5.1	5.2	NA[5]	1.3
B-2	<0.050	<0.001	<0.001	NA	<0.001
B-3	<0.050	<0.001	0.003	NA	0.004
B-4	<0.050	0.20	0.003	NA	0.005
B5	20	1.26	0.033	NA	0.32
B6	0.050	0.005	0.003	NA	0.024
W1(MW1)	<0.050	0.003	0.003	NA	0.006
W2(MW2)	0.29	<0.010	0.006	NA	0.009

---

[1] Results are expressed in milligrams per liter (mg/l), approximately equal to parts per million (ppm).

[2] Source of data is the Aqua Science Engineers Inc. reports (1986).

[3] EPA Method 5020/8015 for TPH-G. Reporting limit unknown.

[4] EPA Method 5020/8020 for BTX. Reporting limit 0.2 mg/L for benzene. Reporting limit for toluene and xylenes unknown.

[5] Not analyzed for this constituent.

TABLE 3

LABORATORY ANALYTICAL RESULTS FOR GROUND WATER[1]
VERSAR INVESTIGATION

Housing Authority of the City of Alameda
Alameda, California

Sample ID	Date	TPH as[2] Gasoline (µg/L)	Benzene[3] (µg/L)	Toluene[3] (µg/L)	Ethylbenzene[3] (µg/L)	Xylenes[3] (µg/L)
MW1	07-91	<50	<0.50	<0.50	<0.50	<1.5
	11-91	<50	<0.50	<0.50	<0.50	<1.5
	02-92	<50	<0.50	<0.50	<0.50	<1.5
	07-92	<50	<0.50	<0.50	<0.50	<1.5
MW2	07-91	<50	3.7	<0.50	0.50	5.1
	11-91	<50	1.1	<0.50	<0.50	4.5
	02-92	<50	<0.50	<0.50	<0.50	1.6
	07-92	<50	<0.50	0.59	<0.50	<1.5
MW3	07-91	<50	<0.50	<0.50	<0.50	<1.5
	11-91	<50	<0.50	<0.50	<0.50	<1.5
	02-92	<50	<0.50	<0.50	<0.50	<1.5
	07-92	<50	<0.50	<0.50	<0.50	<1.5
Cal MCL[4]		--	1	100[5]	680	1,750

[1] Results are expressed in micrograms per liter (µg/L), approximately equal to parts per billion.

[2] DHS Method, LUFT Field Manual, Purge and Trap.

[3] Modified EPA Method 8020, Purge and Trap.

[4] California EPA Maximum Contaminant Level for drinking water (U.S. EPA, 1991).

[5] California DOHS Action Level for drinking water (U.S. EPA, 1991).

TABLE 4

LABORATORY ANALYTICAL RESULTS FOR SOIL[1] DRIVE-CORE BORING SAMPLES, JULY 31, 1992

Housing Authority of the City of Alameda
Alameda, California

Sample ID	TPH as Gasoline[2] (μg/kg)	Benzene[3] (μg/kg)	Toluene[3] (μg/kg)	Ethylbenzene[3] (μg/kg)	Xylenes[3] (μg/kg)	Total Lead[4] (μg/kg)
B8-5	<500	<5	<5	<5	<15	18,000
B9-5	<500	<5	<5	<5	63	NA[5]
B10-6	<500	<5	<5	<5	<15	NA
B11-5	<500	<5	<5	<5	<15	NA
B12-6	<500	<5	<5	<5	<15	NA
B13-6	<500	<5	<5	<5	<15	NA

[1] Results are expressed in micrograms per kilogram (μg/kg), approximately equal to parts per billion.

[2] DHS Method, LUFT Field Manual, Purge and Trap.

[3] Modified EPA Method 8020, Purge and Trap.

[4] EPA Method 7420.

[5] Not analyzed for this constituent.

TABLE 5

LABORATORY ANALYTICAL RESULTS FOR GROUND WATER[1] - DRIVE-CORE BORING SAMPLES, JULY 31, 1992

Housing Authority of the City of Alameda
Alameda, California

Sample ID	TPH as Gasoline[2] (μg/L)	Benzene[3] (μg/L)	Toluene[3] (μg/L)	Ethylbenzene[3] (μg/L)	Xylenes[3] (μg/L)	Total Lead[4] (μg/L)
B8	<50	<0.50	<0.50	<0.50	<1.5	140
B9	2,000	620	<25	<31	180	NA[5]
B10	<50	<0.50	<0.50	<0.50	<1.5	NA
B11	<50	<0.50	<0.50	<0.50	<1.5	NA
B12	<50	1.5	<0.50	<0.50	<1.5	NA
B13	<50	<0.50	<0.50	<0.50	<1.5	NA

[1] Results are expressed in micrograms per kilogram (μg/L), approximately equal to parts per billion.

[2] DHS Method, LUFT Field Manual, Purge and Trap.

[3] Modified EPA Method 8020, Purge and Trap.

[4] EPA Method 7420.

[5] Not analyzed for this constituent.

APPENDIX A

Ground-Water Monitoring and Sampling Procedure

Ground-Water Monitoring and Sampling Procedure

Following the installation and stabilization of a monitoring well, a ground-water sample from the monitoring well will be collected and analyzed, as described below.

1. Check the ambient air surrounding the protective riser using an appropriately calibrated analytical field instruments, and record reading in the field notebook.
2. Remove the wellhead lock and open the hinged cap on the protector casing.
3. Check the air space inside the protector casing around the PVC monitoring tube with an analytical field instrument, and record reading in the field notebook.
4. Remove the cap on top of the PVC casing.
5. Check the air space inside the PVC casing with an analytical field instrument, and record the reading in the field notebook. If anomalous readings are noted, all sampling personnel must don the appropriate respiratory gear.
6. Lower a decontaminated transparent bailer to the water surface in the well and carefully sample the uppermost interval of water. Retrieve the bailer and examine the surface of the water for any non-aqueous floating chemicals.
7. Measure the water level in the well using a decontaminated electronic water level detector with a visible or acoustical indicator. All measurements must be made to the nearest 0.01 foot, and measured relative to the top of the casing. Record the depth of water in the appropriate column of the Monitoring Well Purging Table shown in Figure GW-1.
8. Lower a decontaminated, weighted wire line or the above-water measuring instrument, as appropriate, to the bottom of the well and note the total depth of the well. Record the depth confirmation measurement in the appropriate column of the table.
9. Insert a decontaminated pump or dedicated disposable bailer into the well and begin to purge the well. A calibrated receptacle must be positioned near the

WELL No.	DATE (M/D)	DEPTH of WELL	DEPTH TO WATER (ft)			TIME			PURGE VOLUME (gals)	NOTES
			BP	AP	BS	SP	EP	SS		

Versar
ENVIRONMENTAL RISK MANAGEMENT

Figure GW-1

Monitoring Well Purging Table

____

Field Representative Signature

wellhead to receive all of the fluid purged. The water will be withdrawn from the top of the water column. A minimum of five casing volumes will be purged from the well (or to dryness, as applicable). Do not allow the purge rate to reach a point where the recharge water is entering the well bore in an agitated state. In addition to the requirement to remove five well volumes, a grab sample of the purged fluid will be taken at the commencement of well evacuation and at periodic intervals. The temperature, specific conductance, and pH of the sample will be measured and recorded in the field notebook. Purging will continue until the measured temperature and pH stabilizes.

10. Measure the purged volume in the designated receptacle. After the minimum specified volume has been recovered and the water temperature and pH have stabilized (or the well has been pumped dry), stop pumping, note the time, remove the pumping device, and measure the depth to water. Make the appropriate entries on the table.

11. If the fluid being purged continues to carry a high suspended load, purging may be continued until the recovered fluid is relatively clear. The decision to continue purging beyond five volumes and/or temperature stabilization is to be made by the sampling team supervisor on a case-by-case basis.

The ground-water samples will be collected using the procedures given below.

1. Measure the water level in the well using a decontaminated measuring device. All measurements must be made to the nearest 0.01 foot, and measured relative to the top of the casing. Record the depth of the water in the appropriate column in the Ground Water Monitoring Data Sheet, shown in Figure GW-2.

2. Inspect the dedicated disposable bailer to ensure that the bottom valve assembly is working correctly.

3. Insert the bailer into the PVC monitoring tube and carefully lower it into the well. Take extreme care to avoid agitating and aerating the fluid column in the well.

4. Slowly withdraw the bailer and transfer the water samples to the appropriate containers, as described herein.

WELL No.	DEPTH (ft)	TEMP (C)	pH	Cond (mho/cm)	O.V.A. (ppm)	SHEEN	ODOR	FREE Product	TURBID (NTU)	Cumm. Volume Purged (gals)	NOTES

DATE : ____________ LOCATION : ____

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ENVIRONMENTAL RISK MANAGEMENT

Figure GW-2
Ground Water Monitoring Data Sheet

____
Field Representative Signature

5. Temperature, specific conductance, pH, and organic vapor concentration must be measured on aliquots of water prior to recovery of the primary samples. Water used for field measurements is not to be used to fill sample containers designated for laboratory analysis.

   a. <u>Temperature</u>: The final sample temperature reading is to be obtained by placing an aliquot of water in a flask or thermos bottle and measuring the temperature with the proper probe. After the temperature has stabilized, make the appropriate entry in the table.

   b. <u>Specific Conductance</u>: The specific conductance of the water is to be obtained using the appropriate meter. Carefully follow the manufacturer's instructions concerning operation of the instrument and the required temperature compensation procedures. Make the appropriate entry in the table.

   c. <u>pH</u>: Measure the pH of the water using a pH electrode or similar measuring device inserted into an aliquot of water. Enter the results in the table.

   d. <u>Organic Vapor Concentration</u>: Place 100 milliliters of the water in a jar and seal the top. After 10 minutes, measure the organic vapor concentration in the head space of a jar containing an aliquot of water using an analytical field instrument calibrated to a known concentration of gas using accepted procedures. Record the results in the table.

6. Carefully lower the bailer into the well and recover a fresh water sample.

7. Fill the appropriate sample containers by releasing water from the bailer via the bottom emptying device with a minimum of agitation.

APPENDIX B

Test Data for Monitoring Wells Developed and Purged During July 1992 Fourth Quarterly Ground-Water Sampling

MONITORING WELL PURGING TABLE

Housing Authority of the City of Alameda
Alameda, California

WELL NO.	DATE (M/D)	DEPTH OF WELL	DEPTH TO WATER (ft)			TIME			PURGE VOLUME (gals)	NOTES
			BP	AP	BS	SP	EP	SS		
MW1	7-31-92	14.75'	4.69	7.01	4.71	1105	1125	1410	6.0	
MW2	7-31-92	12.98'	4.75	7.20	5.05	1145	1220	1420	6.1	
MW3	7-31-92	14.42'	4.37	5.56	4.40	1055	1120	1400	6.0	

Field Representative Signature

GROUND-WATER MONITORING DATA SHEET

(Page 1 of 3)

Housing Authority of the City of Alameda
Alameda, California

WELL NO.	DEPTH (ft)	TEMP (C)	pH	COND (mho/cm)	O.V.A. (ppm)	SHEEN	ODOR	FREE PRODUCT	TURBID (NTU)	CUMM. VOLUME PURGED (gals)	NOTES
MW1	4.69	23.3	7.10	2960	---	None	None	None	2.2 (clear)	initial	
MW1	---	22.3	7.09	3110	---	None	None	None	200+	1	
MW1	---	21.3	7.03	3200	---	None	None	None	200+	3	
MW1	7.01	21.0	7.04	3300	---	None	None	None	200+	6	
MW1	4.71	---	---	---	---	None	None	None	(clear)	---	Sample

DATE: 7-31-92 LOCATION: 1457-022

Field Representative Signature

Versar INC. SACRAMENTO

GROUND-WATER MONITORING DATA SHEET

(Page 2 of 3)

Housing Authority of the City of Alameda
Alameda, California

WELL NO.	DEPTH (ft)	TEMP (C)	pH	COND (mho/cm)	O.V.A. (ppm)	SHEEN	ODOR	FREE PRODUCT	TURBID (NTU)	CUMM. VOLUME PURGED (gals)	NOTES
MW2	4.75	22.1	6.73	6530	---	None	Moderate	None	19.5 (clear/ orange)	initial	
MW2	---	21.7	7.12	7450	---	None	Slight	None	200+	1	
MW2	---	21.6	7.13	6950	---	None	Slight	None	200+	3	
MW2	---	21.3	7.07	7090	---	None	Slight	None	200+	6	
MW2	7.20	21.1	7.19	7040	---	None	Slight	None	200+	6.1	
MW2	5.05	---	---	---	---	None	Slight	None	(brown/ cloudy)	---	Sample

DATE: 7-31-92 LOCATION: 1457-022

Field Representative Signature

Versar INC. SACRAMENTO

GROUND-WATER MONITORING DATA SHEET

(Page 3 of 3)

Housing Authority of the City of Alameda
Alameda, California

WELL NO.	DEPTH (ft)	TEMP (C)	pH	COND (mho/cm)	O.V.A. (ppm)	SHEEN	ODOR	FREE PRODUCT	TURBID (NTU)	CUMM. VOLUME PURGED (gals)	NOTES
MW3	4.37	23.7	7.28	2920	---	None	Slight	None	7.1 (clear)	initial	
MW3	---	23.2	7.00	3800	---	None	Slight	None	200+	1.5	
MW3	---	21.9	6.99	3900	---	None	Slight	None	200+	3	
MW3	5.56	21.6	6.95	3830	---	None	Slight	None	200+	6	
MW3	4.40	---	---	---	---	None	Slight	None	(clear)	---	Sample

DATE: 7-31-92 LOCATION: 1457-022

Field Representative Signature

Versar INC. SACRAMENTO

APPENDIX C

Drilling Logs of Drive-Core Borings Drilled During July 31, 1992 Sampling

P 1 of 1

Versar Inc.	DRILLING LOG	PROJECT NO. #1457-022

Supervising Geologist: James G. Jensen	Site Name: Alameda Housing
Log By: JGJ	Boring No: B-8
Date: 7-31-92	Boring Diameter: 2 inch
Drilling Contractor: Precision Sampling, Inc.	Boring Depth: 7 feet
Contractor Lic. No. 636387	Boring Location: southeast of previous excavation site
Rig Type: Hydraulic Driver	
Driller: D. Winslewich	

Depth (ft)	Advanced/ Recovered	Blow Counts	▽ First Water/ ▽ Water Table	Well Construction	USCS Group	Lithology	USCS SOIL DESCRIPTION SOIL CONDITION AND GEOLOGIC INTERPRETATION SOIL TYPE, ROUNDING, SORTING, PERCENT: GRAVEL, SANDS, FINES COLOR, MOISTURE, DENSITY, SECONDARY POROSITY, ODORS, STAINING GEOLOGY: FILL, ALLUVIUM, BEDROCK	Headspace (ppm)
							spud in @ 730 B8-1 no recov.	
							B8-2 - no recov. - cuttings fill - no spl recovery	
							B8-3 - sand-brn, vf-f gr, some pebbls, poorly sotd, loose, damp, sl. odor, fill?	46
							B8-4 - sand-gy brn, vf-f. gr., brn stng, silty, poorly sotd, loose, damp, sl. odor	1000+
							B8-5 - silt - dk gy-black sandy (vf. gr.-f. gr.), subang, poorly sotd, brn stng, mod firm, very moist, [illegible] odor WL 5.5' bysp ls	1000+
							B8-6 - dkgy-blk sandy silt as above brn stng (upper spl)	450
							lower spl: sand-gy-silty, f-m gr., sub∠, poorly sotd, wet, loose-sl. firm, sl odor B8-7 - sand-gy, silty, f-m gr., sub ang, poorly sotd, wet, loose-sl. firm, sl odor	280
							left drill csg in hole to collect wtr spl	
							try to collect spl - too much silt mat'l, insert screened PVC 5' screen + 5' blank 1100 Wtr headspace 320 ppm	

Versar Inc.	**DRILLING LOG**	PROJECT NO. 1457-022

Supervising Geologist: James G. Jensen	Site Name: Alameda Housing
Log By: JGJ	Boring No: B-9
Date: 7-31-92	Boring Diameter: 2 inch
Drilling Contractor: Precision Sampling, Inc.	Boring Depth: 7 feet
Contractor Lic. No. 636387	Boring Location: west of MW 2
Rig Type: Hydraulic Driver	
Driller: D. Winglewich	

Depth (ft)	Advanced/	Recovered	Blow Counts	First Water/▽	Water Table ▽	Well Construction	USCS Group	Lithology	USCS SOIL DESCRIPTION SOIL CONDITION AND GEOLOGIC INTERPRETATION SOIL TYPE, ROUNDING, SORTING, PERCENT: GRAVEL, SANDS, FINES COLOR, MOISTURE, DENSITY, SECONDARY POROSITY, ODORS, STAINING GEOLOGY: FILL, ALLUVIUM, BEDROCK	Headspace (ppm)
									Spud in 0835 Ambient air 0 ppm @ 1' BH - 50ppm	
									B9-1 No rec	
									B9-2 No Rec.	
									B9-3 sand-gry brn, vf-mgr, -sub∡ silty, poorly srtd, damp, brn stng sl odor, mod firm	110
									B9-4 sand-dk gy-vf.-f. grnd, sub∡ silty, poorly srtd, brn stnd, loose-sl. firm moist, mod. odor	660
									B9-5 silt-dk gy-black, sandy (v.f.-f. gr.-sub∡), poorly srtd, mod. firm, wet, mod odor WL 5.5' by spls	180
									B9-6 silt-dk gy-blk, sandy (v.f. gr.-f. gr.-sub∡), poorly srtd, mod. firm, wet, mod odor (gy sand on bottom)	10
									B9-7 sand-gry, fg-mgr, silty, sub∡, poorly srtd, mod firm, wet, sl. odor	320
									insert PVC Screen into hole to collect wtr spl	

P 1 of 1

Versar Inc.	DRILLING LOG	PROJECT NO. 1457-022

Supervising Geologist: James G. Jensen	Site Name: Alameda Housing
Log By: JGJ	Boring No: B-10
Date: 7-31-92	Boring Diameter: 2 inch
Drilling Contractor: Precision Sampling, Inc.	Boring Depth: 7 feet
Contractor Lic. No. 636387	Boring Location: South of MW1
Rig Type: Hydraulic Driver	
Driller: D. Winglewich	

Depth (ft)	Advanced/ Recovered		Blow Counts	First Water/▽ Water Table ▽	Well Construction	USCS Group	Lithology	USCS SOIL DESCRIPTION SOIL CONDITION AND GEOLOGIC INTERPRETATION SOIL TYPE, ROUNDING, SORTING, PERCENT: GRAVEL, SANDS, FINES COLOR, MOISTURE, DENSITY, SECONDARY POROSITY, ODORS, STAINING GEOLOGY: FILL, ALLUVIUM, BEDROCK	Headspace (ppm)
								Spud in 0850	
								B10-1 No Rec	—
								B10-2 No Rec.	—
								B10-3 No Rec	—
								B10-4 Sand - orbrn, vf-med gr, -sub ∠ sl. gravelly, poorly srtd, loose, damp, sl. odor	1
								B10-5 No Rec	—
								B10-6 No Rec @ 6' Spl @ 6.5 for lab - mainly sand - gy - f-m gr., wet, sl. firm, sl. odor	—
								B10-7	
								insert PVC Screen into hole for wtr spl	
								Poor rec - seems to be mainly fill	

P 1 of 1

Versar Inc.	**DRILLING LOG**	PROJECT NO. 1457-022

Supervising Geologist: James G. Jensen	Site Name: Alameda Housing
Log By: JGJ	Boring No: B-11
Date: 7-31-92	Boring Diameter: 2 inch
Drilling Contractor: Precision Sampling, Inc.	Boring Depth: 7 feet
Contractor Lic. No. 636387	Boring Location: East of B-8
Rig Type: Hydraulic Driver	
Driller: D. Winglewich	

Depth (ft)	Advanced/	Recovered	Blow Counts	First Water/▽ Water Table ▽	Well Construction	USCS Group	Lithology	USCS SOIL DESCRIPTION SOIL CONDITION AND GEOLOGIC INTERPRETATION SOIL TYPE, ROUNDING, SORTING, PERCENT: GRAVEL, SANDS, FINES COLOR, MOISTURE, DENSITY, SECONDARY POROSITY, ODORS, STAINING GEOLOGY: FILL, ALLUVIUM, BEDROCK	Headspace (ppm)
								Spud in 1100 - bit ~~refusal-no spl~~ @4' - move over 8" ≈1' 400ppm @ borehole B11-1 NR	
								B11-2 NR	
								B11-3 - Sand - gry brn, vf-m gr., silty, subang, poorly srtd, damp, loose, sl odor	30
								B11-4 sand - gry brn, vf-m gr., silty, subang, poorly srtd, moist, loose, sl. odor	380
								mod. firm, brn stng. B11-5 silt - dk gy-black, sandy (v.f.-f. gr., sub∡) poorly srtd moist, mod odor	960
								WC key spl 5.5' brn stng B11-6 silt - dk gy-black, sandy (vf.-f. gr., sub∡) poorly srtd, mod. firm, wet, ~~mod~~ odor	190
								B11-7 sand - gray f gr.-m. gr., silty, sub ang, poorly srtd, mod. firm, wet, sl. odor set PVC screen in boring to collect wtr spl	260

Versar Inc.	DRILLING LOG	PROJECT NO. 1457-022

Supervising Geologist: James G. Jensen	Site Name: Alameda Housing
Log By: JGJ	Boring No: B-12
Date: 7-31-92	Boring Diameter: 2 inch
Drilling Contractor: Precision Sampling, Inc.	Boring Depth: 7 feet
Contractor Lic. No. 636387	Boring Location: West of previous excavation site
Rig Type: Hydraulic Driver	
Driller: D. Winglewich	

Depth (ft)	Advanced/ Recovered	Blow Counts	▽ First Water/ ▼ Water Table	Well Construction	USCS Group	Lithology	USCS SOIL DESCRIPTION SOIL CONDITION AND GEOLOGIC INTERPRETATION SOIL TYPE, ROUNDING, SORTING, PERCENT: GRAVEL, SANDS, FINES COLOR, MOISTURE, DENSITY, SECONDARY POROSITY, ODORS, STAINING GEOLOGY: FILL, ALLUVIUM, BEDROCK	Headspace (ppm)
							Spud in 1200 B12-1 No Rec.	–
							B12-2 No Rec.	–
							B12-3 clay-gy, silty-v.f. gr. sand, subang, firm, moist, sl. odor	380
							B12-4 sand gray -vf-f -subA gr., subang, silty, poorly srtd, mod. firm, moist, sl odor	760
							B12-5 - No Rec.	—
							B12-6 - sand - gray f-m. gr., subang, silty, poorly srtd, loose-sl. firm, wet, sl. odor	980
							WL 6' by spls B12-7 - sand gray f-m. gr., subang, poorly srtd, loose-sl. firm, wet, sl. odor	120
							set PVC screen in boring to collect wtr spl	

P 1 of 1

Versar Inc.	DRILLING LOG	PROJECT NO. 1457-022

Supervising Geologist: James G. Jensen
Site Name: Alameda Housing
Log By: JGJ
Boring No: B-13
Date: 7-31-92
Boring Diameter: 2 inch
Drilling Contractor: Precision Sampling, Inc.
Boring Depth: 7 feet
Contractor Lic. No. 636387
Boring Location: South of B-8
Rig Type: Hydraulic Driver
Driller: D. Winglewich

Depth (ft)	Advanced/	Recovered	Blow Counts	▽ First Water/	▽ Water Table	Well Construction	USCS Group	Lithology	USCS SOIL DESCRIPTION SOIL CONDITION AND GEOLOGIC INTERPRETATION SOIL TYPE, ROUNDING, SORTING, PERCENT: GRAVEL, SANDS, FINES COLOR, MOISTURE, DENSITY, SECONDARY POROSITY, ODORS, STAINING GEOLOGY: FILL, ALLUVIUM, BEDROCK	Headspace (ppm)
									Spud @ 1330	
									B13-1 - No Rec.	
2									B13-2 - No Rec	
									B13-~~3~~3 - Sand - gry brn, v.f.-m gr., silty, subang, poorly srtd, moist, loose to sl. firm, sl. odor	320
4									B13-4 Sand - gry brn, v.f.-m. gr., silty, subang, poorly srtd, moist, sl. firm, sl. odor	560
									B13-5 ~~Sand~~ ~~silty~~ sandy silt dk gry-blck, v.f.-f. gr., subang, poorly srtd, wet, sl. firm, sl. odor	570
									WL 5.5 by spls	
6									B13-6 Sand - gray, f-m. gr., silty, subang, poorly srtd, wet, sl. firm, sl. odor	650
									B13-7 Sand - gray, f-m gr., silty, subang, poorly srtd, wet, sl. firm, sl. odor	160
8									place PVC screen in boring to coll at wtr spl	

APPENDIX D

Laboratory Analytical Results and Chain-of-Custody Records for Ground-Water and Drive-Core Boring Samples Collected During July 1992 Fourth Quarterly Ground-Water Sampling

Trace Analysis Laboratory, Inc.
3423 Investment Boulevard, #8 • Hayward, California 94545
Telephone (510) 783-6960
Facsimile (510) 783-1512
TAL

August 17, 1992

Mr. James G. Jensen
Versar, Inc.
5330 Primrose Drive, Suite 228
Fair Oaks, California 95628

Dear Mr. Jensen:

Trace Analysis Laboratory received nine water and six soil samples on July 31, 1992 for your Project No. 1457-022, HACA (our custody log number 2368).

These samples were analyzed according to your chain of custody. Our analytical report, the completed chain of custody form, and our analytical methodologies are enclosed for your review.

Trace Analysis Laboratory is certified under the California Environmental Laboratory Accreditation Program. Our certification number is 1199.

If you should have any questions or require additional information, please call me.

Sincerely yours,

Jennifer Pekol
Project Specialist

Enclosures

Trace Analysis Laboratory, Inc.
3423 Investment Boulevard, #8 • Hayward, California 94545
Telephone (510) 783-6960
Facsimile (510) 783-1512

LOG NUMBER: 2368
DATE SAMPLED: 07/31/92
DATE RECEIVED: 07/31/92
DATE EXTRACTED: 08/05/92
DATE ANALYZED: 08/10/92 and 08/11/92
DATE REPORTED: 08/17/92

CUSTOMER: Versar, Inc.

REQUESTER: James G. Jensen

PROJECT: No. 1457-022, HACA

Sample Type: Soil

Method and Constituent:	Units	B8-5		B9-5		B10-6	
		Concentration	Reporting Limit	Concentration	Reporting Limit	Concentration	Reporting Limit
DHS Method:							
Total Petroleum Hydrocarbons as Gasoline	ug/kg	ND	500	ND	500	ND	500
Modified EPA Method 8020 for:							
Benzene	ug/kg	ND	5.0	ND	5.0	ND	5.0
Toluene	ug/kg	ND	5.0	ND	5.0	ND	5.0
Ethylbenzene	ug/kg	ND	5.0	ND	5.0	ND	5.0
Xylenes	ug/kg	ND	15	63	15	ND	15

Method and Constituent:	Units	B11-5		B12-6		B13-6	
		Concentration	Reporting Limit	Concentration	Reporting Limit	Concentration	Reporting Limit
DHS Method:							
Total Petroleum Hydrocarbons as Gasoline	ug/kg	ND	500	ND	500	ND	500
Modified EPA Method 8020 for:							
Benzene	ug/kg	ND	5.0	ND	5.0	ND	5.0
Toluene	ug/kg	ND	5.0	ND	5.0	ND	5.0
Ethylbenzene	ug/kg	ND	5.0	ND	5.0	ND	5.0
Xylenes	ug/kg	ND	15	ND	15	ND	15

Concentrations reported as ND were not detected at or above the reporting limit.

LOG NUMBER: 2368
DATE SAMPLED: 07/31/92
DATE RECEIVED: 07/31/92
DATE EXTRACTED: 08/05/92
DATE ANALYZED: 08/10/92 and 08/11/92
DATE REPORTED: 08/17/92
PAGE: Two

Sample Type: Soil

Method and Constituent:	Units	Method Blank	
		Concentration	Reporting Limit
DHS Method:			
Total Petroleum Hydrocarbons as Gasoline	ug/kg	ND	500
Modified EPA Method 8020 for:			
Benzene	ug/kg	ND	5.0
Toluene	ug/kg	ND	5.0
Ethylbenzene	ug/kg	ND	5.0
Xylenes	ug/kg	ND	15

QC Summary:

% Recovery: 64
% RPD: 1.1

Concentrations reported as ND were not detected at or above the reporting limit.

LOG NUMBER: 2368
DATE SAMPLED: 07/31/92
DATE RECEIVED: 07/31/92
DATE EXTRACTED: 08/10/92
DATE ANALYZED: 08/12/92
DATE REPORTED: 08/17/92
PAGE: Three

Sample Type: Soil

		B8-5		Method Blank		QC Summary	
Method and Constituent:	Units	Concentration	Reporting Limit	Concentration	Reporting Limit	% Recovery	% RPD
EPA Method 7420:							
Lead	ug/kg	18,000	2,500	ND	2,500	91	1.1

Concentrations reported as ND were not detected at or above the reporting limit.

Sample Type: Water

Method and Constituent:	Units	B8		B9		B10	
		Concentration	Reporting Limit	Concentration	Reporting Limit	Concentration	Reporting Limit
DHS Method:							
Total Petroleum Hydrocarbons as Gasoline	ug/l	ND	50	2,000	50	ND	50
Modified EPA Method 8020 for:							
Benzene	ug/l	ND	0.50	620	24	ND	0.50
Toluene	ug/l	ND	0.50	ND	25	ND	0.50
Ethylbenzene	ug/l	ND	0.50	ND	31	ND	0.50
Xylenes	ug/l	ND	1.5	180	84	ND	1.5

Method and Constituent:	Units	B11		B12		B13	
		Concentration	Reporting Limit	Concentration	Reporting Limit	Concentration	Reporting Limit
DHS Method:							
Total Petroleum Hydrocarbons as Gasoline	ug/l	ND	50	ND	50	ND	50
Modified EPA Method 8020 for:							
Benzene	ug/l	ND	0.50	1.5	0.50	ND	0.50
Toluene	ug/l	ND	0.50	ND	0.50	ND	0.50
Ethylbenzene	ug/l	ND	0.50	ND	0.50	ND	0.50
Xylenes	ug/l	ND	1.5	ND	1.5	ND	1.5

Concentrations reported as ND were not detected at or above the reporting limit.

LOG NUMBER: 2368
DATE SAMPLED: 07/31/92
DATE RECEIVED: 07/31/92
DATE ANALYZED: 08/08/92 and 08/10/92
DATE REPORTED: 08/17/92
PAGE: Five

Sample Type: Water

Method and Constituent:	Units	MW-1		MW-2		MW-3	
		Concentration	Reporting Limit	Concentration	Reporting Limit	Concentration	Reporting Limit
DHS Method:							
Total Petroleum Hydrocarbons as Gasoline	ug/l	ND	50	ND	50	ND	50
Modified EPA Method 8020 for:							
Benzene	ug/l	ND	0.50	ND	0.50	ND	0.50
Toluene	ug/l	ND	0.50	0.59	0.50	ND	0.50
Ethylbenzene	ug/l	ND	0.50	ND	0.50	ND	0.50
Xylenes	ug/l	ND	1.5	ND	1.5	ND	1.5

Method and Constituent:	Units	Method Blank	
		Concentration	Reporting Limit
DHS Method:			
Total Petroleum Hydrocarbons as Gasoline	ug/l	ND	50
Modified EPA Method 8020 for:			
Benzene	ug/l	ND	0.50
Toluene	ug/l	ND	0.50
Ethylbenzene	ug/l	ND	0.50
Xylenes	ug/l	ND	1.5

QC Summary:

% Recovery: 90, 96 and 104
% RPD: 11, 0.7 and 16

Concentrations reported as ND were not detected at or above the reporting limit.

LOG NUMBER: 2368
DATE SAMPLED: 07/31/92
DATE RECEIVED: 07/31/92
DATE EXTRACTED: 08/05/92
DATE ANALYZED: 08/06/92
DATE REPORTED: 08/17/92
PAGE: Six

Sample Type: Water

		B8		Method Blank		QC Summary	
Method and Constituent:	Units	Concentration	Reporting Limit	Concentration	Reporting Limit	% Recovery	% RPD
EPA Method 7420:							
Lead	ug/l	140	100	ND	100	104	*

Concentrations reported as ND were not detected at or above the reporting limit.

* The RPD is not reportable since the sample prepared in duplicate was not detectable.

Louis W. DuPuis
Quality Assurance/Quality Control Manager

p2 of 2

Versar

CHAIN OF CUSTODY RECORD

PROJECT NO. 1457-022

PROJECT NAME HACA

INDUSTRIAL HYGIENE SAMPLE Y [✓ N]

SAMPLERS: *(Signature)*

(Printed) JAMES G. JENSEN

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TPH-G/BTEX	TOTAL LEAD							REMARKS log 2368
B8-5	7/31/92	0825		X	Boring 8	1	X	X							Soil Spl
B9-5	7/31/92	0905		X	" 9	1	X								" "
B10-6	7/31/92	0945		X	" 10	1	X								" "
B11-5	7/31/92	1150		X	" 11	1	X								" "
B12-6	7/31/92	1235		X	" 12	1	X								" "
B13-6	7/31/92	1350		X	" 13	1	X								" "

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
(Printed)		(Printed)	(Printed)		(Printed)

Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks
	7/31/92 1630	for TAL	7/31/92 16:30	NORMAL 14-DAY T/A · walked in · soil · BT, ia, 4-7
(Printed) JAMES G. JENSEN		(Printed) Louis DeRis		

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

Versar

p1of 2

CHAIN OF CUSTODY RECORD

PROJECT NO. 1457-022	**PROJECT NAME** HACA	**INDUSTRIAL HYGIENE SAMPLE**	Y [✓ N]
SAMPLERS: *(Signature)* James G. Jensen	**(Printed)** JAMES G. JENSEN		2368

PARAMETERS

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TPH-G/BTEX	TOTAL LEAD	
MW 1	7/31/92	1410		X	MW 1	3	X		Water Spl
MW 2	7/31/92	1420		X	MW2	3	X		" "
MW 3	7/31/92	1400		X	MW3	3	X		" "
B 8	7/31/92	1430		X	Boring 8	3	X	X	" "
B 9	7/31/92	1445		X	" 9	2	X		" "
B 10	7/31/92	1452		X	" 10	2	X		" "
B 11	7/31/92	1458		X	" 11	2	X		" "
B 12	7/31/92	1502		X	" 12	2	X		" "
B 13	7/31/92	1505		X	" 13	2	X		" "

Relinquished by: *(Signature)*	**Date / Time**	**Received by:** *(Signature)*	**Relinquished by:** *(Signature)*	**Date / Time**	**Received by:** *(Signature)*
(Printed)		**(Printed)**	**(Printed)**		**(Printed)**
Relinquished by: *(Signature)* James G. Jensen	**Date / Time** 7-31-92 ~~1630~~ / 1630	**Received for Laboratory by:** *(Signature)* for TA	**Date / Time** 7/31/92 / 16:30	**Remarks** NORMAL 14-DAY T/A.	
(Printed) JAMES G. JENSEN		**(Printed)** Louis DeLis			

Remarks NORMAL 14-DAY T/A.
· volked in
· water
· 2 or 3-40-ml HCl, ice, 1-500ml HNO3 metals
· ~~4~~ T, Green ref.

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink)

TAL Trace Analysis Laboratory, Inc.

TOTAL PETROLEUM HYDROCARBONS AS GASOLINE (TPH-G) FOR SOIL, BY PURGE AND TRAP

Method:

This method is based on the "Leaking Underground Fuel Tank (Luft) Field Manual," May 1988, prepared by the State of California, and on the "Regional Board Staff Recommendations," May 1989, by the North Coast, San Francisco, and Central Valley Regional Water Quality Control Boards. This method uses an alternative column, flow rate, and temperature program as specified below.

Sample Preparation:

Approximately 15 grams of the soil sample are added to 10 ml of methanol. The sample is extracted by agitation.

Sample Introduction:

Methanol extracts are introduced to the gas chromatograph (GC) by EPA Method 5030, Purge and Trap.

Gas Chromatography Analysis:

The volatile organics are separated on a 6-ft x 2 mm I.D. gas chromatography column packed with 5% SP-1200/1.75% Bentone-34 on Supelcoport. A flame ionization detector (FID) is used to detect total petroleum hydrocarbons as gasoline (TPH-G). The FID is preceded by a photoionization detector (PID).

Gas Chromatograph Conditions:

CARRIER GAS:	Nitrogen
FLOW RATE:	30 ml/min.
INJECTOR TEMPERATURE:	240^{0} C
DETECTOR TEMPERATURE:	270^{0} C
INITIAL TEMPERATURE:	50^{0} C
Hold for 2 minutes	
PROGRAM RATE:	6^{0} C/min.
FINAL TEMPERATURE:	90^{0} C
Hold for 17 minutes	

Calculation:

Total Petroleum Hydrocarbons as Gasoline is quantified by comparing the sum of the area of peaks from the sample to the sum of the area of peaks in the gasoline standard.

3/13/91

BENZENE, TOLUENE, XYLENES, AND ETHYLBENZENE (BTXE) FOR SOIL, BY PURGE AND TRAP

Method:

This method is EPA Method 8020 as referenced in the "Leaking Underground Fuel Tank (Luft) Field Manual," May 1988, prepared by the State of California, and on the "Regional Board Staff Recommendations," May 1989, by the North Coast, San Francisco, and Central Valley Regional Water Quality Control Boards. This method uses an alternative carrier gas as specified below.

Sample Preparation:

Approximately 15 grams of the soil sample are added to 10 ml of methanol. The sample is extracted by agitation.

Sample Introduction:

Methanol extracts are introduced to the gas chromatograph (GC) by EPA Method 5030, Purge and Trap.

Gas Chromatography Analysis:

The volatile organics are separated on a 6-ft x 2 mm I.D. gas chromatography column packed with 5% SP-1200/1.75% Bentone-34 on Supelcoport. A photoionization detector (PID) is used to detect BTXE. The PID is followed by a flame ionization detector (FID).

Gas Chromatograph Conditions:

CARRIER GAS:	Nitrogen
FLOW RATE:	30 ml/min.
INJECTOR TEMPERATURE:	240^{0} C
DETECTOR TEMPERATURE:	270^{0} C
INITIAL TEMPERATURE: Hold for 2 minutes	50^{0} C
PROGRAM RATE:	6^{0} C/min.
FINAL TEMPERATURE: Hold for 17 minutes	90^{0} C

Calculation:

BTXE are identified by comparing the retention times of the sample peaks to those of the standards. BTXE are quantified by comparing the area of the sample peaks to those of the standards. If BTX or E is present and Total petroleum Hydrocarbons as Gasoline (TPH-G) is not, the analysis is confirmed by using a second column or a gas chromatograph mass spectrometer (GC/MS).

3/13/91

TOTAL PETROLEUM HYDROCARBONS AS GASOLINE (TPH-G) FOR WATER, BY PURGE AND TRAP

Method:

This method is based on the "Leaking Underground Fuel Tank (Luft) Field Manual," May 1988, prepared by the State of California, and on the "Regional Board Staff Recommendations," May 1989, by the North Coast, San Francisco, and Central Valley Regional Water Quality Control Boards. This method uses an alternative column, flow rate, and temperature program as specified below.

Sample Preparation:

There is no sample preparation other than dilution.

Sample Introduction:

Water samples are introduced to the gas chromatograph (GC) by EPA *Method 5030, Purge and Trap. Up to 5 ml of sample is purged by this* method.

Gas Chromatography Analysis:

The volatile organics are separated on a 6-ft x 2 mm I.D. gas chromatography column packed with 5% SP-1200/1.75% Bentone-34 on Supelcoport. A flame ionization detector (FID) is used to detect total petroleum hydrocarbons as gasoline (TPH-G). The FID is preceded by a photoionization detector (PID).

Gas Chromatograph Conditions:

CARRIER GAS:	Nitrogen
FLOW RATE:	30 ml/min.
INJECTOR TEMPERATURE:	240° C
DETECTOR TEMPERATURE:	270° C
INITIAL TEMPERATURE: Hold for 2 minutes	50° C
PROGRAM RATE:	6° C/min.
FINAL TEMPERATURE: Hold for 17 minutes	90° C

Calculation:

Total Petroleum Hydrocarbons as Gasoline is quantified by comparing the sum of the area of peaks from the sample, to the sum of the area of peaks in the gasoline standard.

1/2/90

BENZENE, TOLUENE, XYLENES, AND ETHYLBENZENE (BTXE) FOR WATER, BY PURGE AND TRAP

Method:

This method is EPA Method 8020 as referenced in the "Leaking Underground Fuel Tank (Luft) Field Manual," May 1988, prepared by the State of California, and on the "Regional Board Staff Recommendations," May 1989, by the North Coast, San Francisco, and Central Valley Regional Water Quality Control Boards. This method uses an alternative carrier gas as specified below.

Sample Preparation:

There is no sample preparation other than dilution.

Sample Introduction:

Water samples are introduced to the gas chromatograph (GC) by EPA Method 5030, Purge and Trap.

Gas Chromatography Analysis:

The volatile organics are separated on a 6-ft x 2 mm I.D. gas chromatography column packed with 5% SP-1200/1.75% Bentone-34 on Supelcoport. A photoionization detector (PID) is used to detect BTXE. The PID is followed by a flame ionization detector (FID).

Gas Chromatograph Conditions:

CARRIER GAS:	Nitrogen
FLOW RATE:	30 ml/min.
INJECTOR TEMPERATURE:	240° C
DETECTOR TEMPERATURE:	270° C
INITIAL TEMPERATURE: Hold for 2 minutes	50° C
PROGRAM RATE:	6° C/min.
FINAL TEMPERATURE: Hold for 17 minutes	90° C

Calculation:

BTXE are identified by comparing the retention times of the sample peaks to those of the standards. BTXE are quantified by comparing the area of the sample peaks to those of the standards. If BTX or E is present and Total petroleum Hydrocarbons as Gasoline (TPH-G) is not, the analysis is confirmed by using a second column or a gas chromatograph mass spectrometer (GC/MS).

1/2/90

EPA METHOD 7420 - LEAD (Pb) BY FLAME

Method:

This method is from "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846," 2nd Edition, by the U.S. Environmental Protection Agency.

Sample Preparation:

Water samples are prepared by EPA Method 3010, which is a digestion using acid and heat.

Soil samples are prepared by EPA Method 3050. The sample is dried, sifted, and digested with acid, hydrogen peroxide, and heat.

Atomic Absorption Conditions:

Lamp:	Lead
Wavelength:	283.3 nm
Heat Source:	Acetylene-Air flame

Atomic Absorption Analysis:

The sample is directly aspirated into the flame. The element entering the flame absorbs energy from the lamp. The atomic absorption unit then displays the concentration of the sample aspirated into the flame.

Calculation:

The concentration displayed is adjusted to account for the amount of sample used and the subsequent dilution of the sample.

1/2/90